Workshop Proceedings

BEHAVIOURAL INTERVENTIONS IN DENGUE CONTROL IN MALAYSIA

Edited by:
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WORKSHOP PROCEEDINGS ON BEHAVIOURAL INTERVENTIONS IN DENGUE CONTROL IN MALAYSIA

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FOREWORD

The two main mosquito vector species incriminated in the transmission of dengue fever in Malaysia, *Aedes aegypti* and *Aedes albopictus,* are found in and around human habitations and their continued breeding is very much related to human behaviour. In the absence of a vaccine for the prevention and control of DF/DHF, eliminating the breeding places of *Aedes* mosquitoes is still the only effective strategy to control DF/DHF.

Indiscriminate rubbish disposal, especially at construction sites, factories, vacant land, cemeteries and other public places, provide the environment to breed mosquitoes. Having a good rubbish collection and disposal system will not solve the problem if the community does not contribute towards keeping the environment clean. A healthy, *Aedes* free environment, can only be achieved through individual responsibility, community participation and with support from the health department and the local authority.

The project "Promoting Behavioural Change in the Control of Dengue and Dengue Haemorrhagic Fever in Malaysia" is a top-down IRPA project initiated in mid 1996 and was completed in mid 2000. It examined important social, cultural and behavioural factors associated with the prevention and control of dengue fever among the various target groups. Each study worked towards developing and testing a behavioural intervention approach appropriate for control of dengue, particularly with respect to prevention of vector breeding and promoting community participation.

I would like to congratulate Universiti Sains Malaysia, Penang for taking the initiative to publish this book and to all the researchers from the Institute for Medical Research, Kuala Lumpur; Universiti Sains Malaysia, Penang; Universiti Malaysia Sarawak; State Health Departments of Johore, Penang and Sarawak; and Dewan Bandaraya Kuala Lumpur for their valuable contributions in the research findings.

It is hoped that the publication of this book will provide useful information to health planners and those involved in dengue control work as well as researchers who are interested in the subject.

DATU' DR. MOHAMAD TAHA BIN ARIF
DIRECTOR GENERAL OF HEALTH MALAYSIA

PREFACE

The primary focus of health education programmes is to bring about behaviour change. Health professionals are discovering that changing unhealthy behaviour is difficult. However, when this is successful, the impact is extremely rewarding. The challenge therefore is to find appropriate and effective strategies that take into consideration human and environment factors that influence positive behaviours. There is sufficient evidence to show that biotechnology alone cannot prevent or control the transmission of diseases if people will not participate or change their behaviours.

Dengue is the most important viral disease in the world. It remains endemic in Malaysia despite enormous efforts and money being put into its control. The rising incidence of dengue cases in the last decade has been found to be associated with rapid urbanization, population growth and poor living conditions which led to increased breeding areas for the *Aedes* mosquitoes and the easy spread of the virus. Why are the people maintaining practices that promote mosquito breeding? Why are they resistant to insecticide spraying of their homes? To answer these questions, one has to understand human social life and behaviour.

A Panel-Initiated research project "Promoting Behavioural Change in the Control of Dengue and Dengue Haemorrhagic Fever in Malaysia", funded by the Ministry of Science, Technology and Environment under the mechanism of Intensification of Research Priority Areas (IPRA), was initiated in 1996. This was a multi-center study involving the Institute for Medical Research (IMR), Universiti Sains Malaysia and Universiti Sarawak Malaysia as well as the State Health Departments of Johore, Penang and Sarawak. Dr. Haliza Mohd. Riji from IMR was the principal investigator and project coordinator with other co-investigators from the above-mentioned institutions.

The project involved four study sites covering Penang, Kuala Lumpur, Johore and Sarawak and focused on urban residential, rural traditional and urban construction locales. It aimed at obtaining an understanding of the social and human factors that influence the prevention and control of dengue and dengue haemorrhagic fever among various selected target groups. Findings of these basic studies, contributed to the development and implementation of an appropriate intervention for dengue control at each study site. These interventions promoted behaviour of individuals and communities that aid in dengue control such as the prevention of mosquito breeding.

One of the outcomes of the research was a national workshop, jointly organized by Universiti Sains Malaysia and the Institute of Health Promotion, on 26-27 June 2000 in Penang, with the aim of bringing together dengue control programme managers, policy-makers, and researchers to discuss research findings and to formulate recommendations for further action. Specifically the objectives of the workshop were: (i) to present an overview of the current dengue/dengue haemorrhagic fever situation

in Malaysia and selected states, (ii) to review the strengths and weaknesses of behavioural interventions adopted in the various study sites for dengue control; and (iii) to discuss and propose recommendations to improve national dengue control with emphasis on enhancing intersectoral efforts and fostering greater cooperation between communities and health authorities.

This publication consists of papers that were presented at the workshop. The first section cover topics on the epidemiological aspects, governmental policies and strategies related to dengue control in Malaysia, issues pertaining to the control of *Aedes*, legislation and control of dengue, role of health education and promoting behavioural change in dengue prevention and control. Section two presents findings of the four studies conducted in Penang, Kuala Lumpur, Johore and Sarawak. The report concludes with recommendations on behavioural interventions in dengue control that were proposed by the workshop participants.

CONTENTS

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1. INTRODUCTION

Dengue fever/dengue haemorrhagic fever (DF/DHF) is the most important emerging viral disease affecting nearly half of the world's population. It is estimated that there are between 50 to 100 million cases of DF and about 500,000 cases of DHF which require hospitalization every year.

In recent years, dengue has become a major international public health concern. Many countries and areas in Asia as well as in Latin America have been experiencing unusually high levels of dengue/dengue haemorrhagic fever activity.

In the WHO South-east Asia Region, over the past 15 years DF/DHF has become a leading cause of hospitalization and death among children. The annual incidence of DF cases is estimated to be between 20-30 million and of DHF between 200,000 and 400,000 cases with 10,000 deaths. During 1996 - 1998, an increasing trend in morbidity associated with DF/DHF has been observed in India, Indonesia, Maldives, Myanmar, Sri Lanka and Thailand.

In the Western Pacific Region, DF/DHF continues to be a serious public health concern. Over the past two decades, 33 out of the 36 countries and areas in the Region have reported cases of DF/DHF. The disease has been reported almost annually by 15 countries, including Cambodia. China, Lao People's Democratic Republic (Lao PDR), Malaysia, the Philippines, Singapore, Vietnam and several Pacific Island countries and area.

During 1993-1997 a total of 552,088 cases were reported from the Region. Of these, 70% were reported from Vietnam alone. In recent years the dengue incidence has been increasing steadily throughout the Region. In 1998, a total of 151,124 cases with 787 deaths were reported which was the highest number of cases recorded since 1991.

Over the last two decades, the case fatality rate (CFR) has been declining in most of the endemic countries in the Region due to a better understanding of the pathogenesis and improvement in case management. The overall CFR in the Region is now less than 1%. However, in some countries, the CFR still exceeds 4% due to factors such as late admission to hospitals (this includes Malaysia).

In newly-industrialized countries such as Malaysia and Singapore where the dengue incidence had declined due to successful vector control programmes, a resurgence in

cases has been reported since 1994.

2. CURRENT CONTROL STRATEGIES BY WHO

As there is no specific treatment nor a curative drug or vaccine currently available, prevention and control of dengue transmission must be carried out through comprehensive programmes for the control of the vector. The recently adopted global strategy based on a resolution of the 46th World Health Assembly in 1993 for the prevention and control of the DF/DHF vector recommended five broad areas for action: (1) selective integrated mosquito control with community and intersectoral participation; (2) active surveillance based on a strong health system; (3) emergency preparedness; (4) capacity-building, and (5) vector control research.

3. DENGUE PROGRAMME IN MALAYSIA

The earliest report of a dengue fever in Malaysia was from Penang in 1902. However, the first report of the sinister dengue fever with haemorrhagic manifestations was made only in 1962 in Penang Island. Since then, the disease has become endemic throughout the country. In 1973, there was a major outbreak of Dengue Haemorrhagic Fever (DHF). Subsequently, in 1974, a plan of action for the prevention and control of DF and DHF was put into immediate effect and the disease was made notifiable. This was followed by the introduction of the Destruction of Disease Bearing Insect Act (DDBIA 1975) to control the breeding of disease-bearing insects.

The Dengue Control Programme was established in the year 1974 under the Epidemiology Unit, Public Health Services Division, Ministry of Health. In 1981, the programme was integrated with the vector-borne disease control programme. In 1993 the Dengue Control Programme together with other Vector-borne disease control programmes were integrated with the Disease Control Programme, Public Health Services Division.

The objectives of the Dengue Control Programme are:-

- To reduce the morbidity and mortality of DF/DHF so that it will no longer pose as a public health problem.
- To reduce the breeding of *Aedes* mosquitoes to a level of below 1% *Aedes* Premise Index (AI).
- To increase public support and community participation in the prevention and control of dengue.

4. ISSUES AND CHALLENGES IN *AEDES* SURVEILLANCE AND CONTROL

Dengue and dengue haemorrhagic fever are major public health problems in Malaysia. From 1998 the number of cases reported showed an upward trend until 1998 except for a slight drop in 1994. There was a dramatic increase in the number of dengue cases from 1995 until 1998. In 1995 a total of 6,543 cases were reported and this figure shot up to 14,255 cases in 1996, an increase of 117.9%. In 1997 a total of 19,429 cases were reported, an increase of 36.3% over the 1996 figure. In 1998 a total of 27,381 cases were reported, an increase of 40.9% over the 1997 figure. The reasons for this increase is due to the period of rapid urbanization and population growth (both local and foreign migrations to cities), a different life style (throwing of non-biodegradable containers), rapid transportation and poor living conditions (poor water supply and poor scavenging services at squatter areas. All these gave rise to increased breeding areas for the *Aedes* mosquitoes and the easy spread of the virus.

In 1999 there was a drop in number of cases notified to 9,947 from 27,381 cases in 1998 that is a drop of 63.7%. One of the reasons for this drop is the successes of the 'National Cleanliness and Anti-mosquito Campaign' that was launched in April 1999 with the objective of increasing awareness among all citizens on the cleanliness at home, work place and surroundings and its relationship to mosquito-borne diseases. Another reason for the reduction of cases is in the predominance of Dengue 2 virus for the last few years, contributing to the herd immunity to this virus.

The two main mosquito vector species, incriminated in the transmission of dengue fever in Malaysia are *Aedes aegypti* and *Aedes albopictus*. The two species are house frequenting and are found in and around human habitations. They breed in artificial and natural containers and receptacles which hold clean and clear water. Containers such as ant traps, earthen jars, flower pots, drums, buckets, basins, bowls, coconut shells and rubber tyres are some of the preferential breeding sites. During the routine larval surveys carried out by the district dengue control teams some neglected and unusual breeding sites are detected. Among these are cocoa pods, septic tanks, abandoned housing projects, roof gutters, refrigerator trays, vacant land, cemeteries and construction sites.

The strategies employed in vector control are directed both at the larval and adult stages of the *Aedes* mosquitoes. For larval control, the activities carried out are environmental management measures, source reduction measures, use of Abate larvicide, regular house inspection and the enforcement of the Destruction of Disease-Bearing Insects Act, 1975. For adult control, fogging activities are instituted as soon as a case of dengue is notified. The use of household pesticides by the public also helps to reduce the adult mosquito population to a certain extent; The use of personal protection measure such as mosquito nets repellents and screening of windows and doors are being encouraged.

Since the launching of the Dengue Control Programme in 1974, house inspection has

been the main strategy employed for the detection of *Aedes* breeding in and around the houses. House inspection is carried out daily by the district dengue control team and also by the local authority who has its own teams. The purpose of the house visitation is to educate the people on ways and means to prevent *Aedes* breeding including the proper use of Abate larvicide and looking for *Aedes* breeding in individual households. Another reason for house visits is to ensure that the house owner carries out source reduction measures. The results of the *Aedes,* larval surveys can be used to assess regularly the *Aedes* situation and to pin point high risk areas so that their areas can be identified as priority areas for control, the enforcement of the Destruction of the Disease Bearing Insect Act, 1975 carried out during house inspection. Although we have managed to control the *Aedes* House Index to a level of around 1% the incidence of dengue continued to climb from 6,543 cases in 1995 to 27,381 cases in 1998. From here it can be reasoned out that the *Aedes* House Index is not a sensitive indicator and thus not a reliable one for assessing *Aedes* activity and it does not correlate with the incidence of dengue. Another possible reason is that mosquitoes are effective vectors and can maintain the transmission of dengue even at low levels of *Aedes* density.

Some of the issues encountered in house inspection are the poor coverage and inadequate visits to the houses. Since only one dengue control team is provided for one health district, only 200 houses can be inspected in a day. This is compounded by the fact that not all local authorities have their own dengue control teams thus leading to poor coverage of premises, the mushrooming of new housing estates in recent years is another big problem. The presence of newly discovered and neglected breeding sites such as construction sites, vacant land, roadside dumping sites, cemeteries, abandoned housing projects are additional sources of *Aedes* breeding which will trigger the outbreaks of dengue. In order to improve the coverage and frequency of *Aedes* house inspection a number of initiatives have been adopted such as

- The number of dengue teams by health district will be reviewed in line with the increase in the number of houses in the districts.

- The local authority especially the large Municipalities will be requested to form its own vector control unit while in the smaller district councils the local health offices will continue to assist in the *Aedes* work.

- There are plans for the Ministry of Health to be responsible for dengue control activities in 52 of the district councils.

5. REPRIORITIZATION OF AREAS FOR *AEDES* SURVEILLANCE AND CONTROL

Prior to 1995 the main thrust of *Aedes* inspection is in and around houses where other areas are neglected. Analysis of dengue outbreak reports indicate that cases occurred in areas of low *Aedes* indices and investigations revealed heavy breeding outside

houses and in places of occupation of patients. There were also reports of dengue outbreaks in schools, hospitals and cases reported in houses traced to *Aedes* breeding in and nearby construction sites.

A prioritization programme for *Aedes* surveillance was formulated in 1997 to replace the old plan. The old plan comprises 4 priority areas while the new plan consists of only 3 priority areas. In the new plan for surveillance, Priority 1 areas for the *Aedes* surveillance are those areas with dengue outbreaks, urban areas with large number of construction sites and areas with high *Aedes* density, Priority II areas are those areas with urban setting with a single case of dengue but with high *Aedes* density and in areas with high human concentration such as schools, hospitals and factories. Lastly, Priority III areas are mainly the rural areas without dengue cases but with high *Aedes* density such as plantations, estates, vacant and rubbish dumping sites and cemeteries.

6. FUTURE DIRECTION

- House and premises inspection are the main strategy for *Aedes* surveillance in the dengue control programme. A reprioritization plan has been formulated to include and expand the scope of *Aedes* inspection to cover other facilities.

- The current indices used for *Aedes* surveillance are not sensitive and accurate for forecasting outbreaks. The recent studies by IMR indicated a direct correlation between the ovitrap index, rainfall and the occurrence of dengue cases. This may form the basis of an early warning mechanism for the prediction of dengue outbreaks. In the long term the Geographical Information System (G.I.S.) will be used to develop an effective *Aedes* monitoring system taking into consideration *Aedes* population (ovitrap index), dengue incidence and other epidemiological, climatic and human population parameters.

The mushrooming of small private unlicensed pest control operators has hindered the current vector control activities carried out by the Government sector. There is difficulty in monitoring and supervising the activities carried out by these people.

Therefore there is an urgent need to formulate new PEST CONTROL OPERATOR regulations under the PESTICIDES ACT 1974 which is currently being reviewed. This Act will allow for accreditation and the monitoring of pesticides being used by the pest control operators and to ensure proper training for them. This will facilitatie the privatisation of vector control activities in the future.

PART I

Overview of Dengue Fever Control in Malaysia

DENGUE SITUATION IN MALAYSIA: NATIONAL TRENDS AND STRATEGIES FOR CONTROL

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1. INTRODUCTION

Dengue is an arboviral disease complex which includes Dengue (DF) and Dengue Haemorrhagic Fever (DHF) and its subsequent dengue shock syndrome (DDS). A dengue virus infection may be asymptomatic or it may lead to undifferentiated viral fever syndrome, dengue fever, dengue haemorrhagic fever or dengue shock syndrome.

Dengue like the mosquito that carries it, is found throughout tropical regions of the world. It is reported from over 100 countries with approximately 2,500 million people at risk. Annually there are millions of infections and at times tens of thousands of death. Dengue has now become the most important mosquito-borne virus disease in the world. It affects young and old, rich and poor alike especially those living in densely crowded urban areas throughout the tropics.

The earliest report of a dengue fever in Malaysia was from Penang in 1902. However, the first report of the sinister dengue fever with haemorrhagic manifestations was made only in 1962 in Penang Island. Since then, the disease has become endemic throughout the country. In 1973 there was a major outbreak of Dengue Haemorrhagic Fever (DHF). Subsequently, in 1974, a plan of action for the prevention and control of DF and DHF was put into immediate effect and the disease was made notifiable. The Destruction of Disease Bearing Insect Act (DDBIA 1975) was introduced in 1975.

Dengue Control Programme was established in the year 1973 under the Epidemiology Unit, Public Health Services Division, Ministry of Health. In 1981 the programme was integrated with the Vector-borne Disease Control Programme. In 1993, the Dengue Control Programme together with other vector-borne disease control programmes were integrated with the Disease Control Programme, Public Health Services Division .

The objectives of the Dengue Control Programme are:-

- To reduce the morbidity and mortality of DF/DHF so that it will no longer pose a public health problem.
- To reduce the breeding of *Aedes* mosquitoes to a level of below 1% *Aedes* Premise Index (A1).

- To increase public support and community participation in the prevention and control of dengue.

The targets set for controlling DF/DHF under the 8th Malaysia Plan are as follows:-

- Not more than 50 cases of DF/100,000 population.
- Not more than 2 cases of DHF/100,000 population.
- Case Fatality Rate of DF/DHF not more than 0.2%.
- Case Fatality Rate of DHF not more than 1.0%.

The strategies used in the control of DF/DHF are as follows:

- Epidemiological surveillance through prompt case notification through telephone followed by written notification.
- Laboratory diagnosis through the use of rapid screening tests and confirmation by standard laboratory technique.
- Improved clinical management through case detection and institution of supportive management of care in hospital.
- Disease control through case investigation and follow-up.
- Vector control through source reduction, done by search and destroy activities, anti-adult operation through chemical fogging, and legislation.
- Entomological surveillance through larval survey and adult survey.
- Interagency collaboration and co-operation for control of dengue in specific population sub-groups and high risk areas, e.g., schools, construction sites, etc.
- Health education activities including community participation through community involvement in activities related to dengue control.

2. ACTIVITIES UNDER DISEASE SURVEILLANCE

Dengue Fever (DF) and Dengue Haemorrhagic Fever (DHF) is a notifiable disease in this country since 1974. It is compulsory for all Medical Officers to notify the disease under the Prevention and Control of Infections Diseases Act, 1988.

All cases diagnosed clinically are to be notified by the Medical Officer to the nearest District Health Office within 24 hours. One should not wait for laboratory confirmation of the case before notification. (Appendix 1)

Early notification is very essential for control measures to be instituted immediately. Delay in notification will lead to delay in control measures taken by health personnel which will further lead to occurence of outbreaks. All cases notified are investigated to pin-point the source of infection. (Appendix 2)

Confirmation of a case by laboratory diagnosis depends very much on the time the specimen is taken and the type of test used. Normally two specimens are required for confirmation in most cases.

The following criteria are used as a guideline for diagnosis of dengue fever and dengue haemorrhagic fever. The use of these criteria may help prevent over diagnosis of the disease and help in early notifications.

2.1 Dengue Fever

Clinical description

An acute febrile illness of 2-7 days duration with two or more of the following manifestations: headache, retro-orbital pain, myalgia, arthralgia, rash, haemorrhagic manifestations and leucopenia.

Laboratory criteria for diagnosis one or more of the following:

- Isolation of the dengue virus from serum, plasma, leukocytes, or autopsy samples.
- Demonstration of a fourfold or greater change in reciprocal IgG or IgM antibody titres to one or more dengue virus antigens in paired serum samples.
- Demonstration of dengue virus antigen in autopsy tissue by immunohistochemistry of immunofluorescence or in serum samples by EIA.
- Detection of viral genomic sequences in autopsy tissue, serum or CSF samples by polymerase chain reaction (PCR).

Case classification

Suspected: A case compatible with clinical description.

Probable: A case compatible with the clinical description with **one or more** of the following:

- Supportive serology (reciprocal haemogglutination inhibition antibody titre ≥ 1280, comparable IgG EIA titre of positive IgM antibody test in late acute or convalescent-phase serum specimen).
- Occurrence at same location and time as other confirmed cases of dengue fever.

Confirmed: A case compatible with the clinical description that is laboratory-confirmed.

2.2 Dengue Haemorrhagic Fever

A probable or confirmed case of Dengue and haemorrhagic tendencies evidenced by, **one or more** of the following:

- Positive tourniquet test.
- Petechiae, ecchymoses or purpura.
- Bleeding from mucosa, gastrointestinal tract, injection sites of other sites.
- Haematermesis or melena.

and thrombocytopenia (100,000 cells per mm3 or less)
and evidence of plasma leakage due to increased vascular permeability manifested by one or more of the following:

- A rise in average haemotocrit for age and sex ≥ 20%.
- A ≥ 20% drop in haemotocrit following the volume replacement treatment compared to baseline.
- Signs of plasma leakage (pleural effusion, ascites, hypoproteinaemia).

2.3 Dengue Shock Syndrome

All the above criteria for DHF plus evidence of circulatory failure manifested by

- Rapid and weak pulse, and narrow pulse; or
- Hypotension for age, and cold, clammy skin and restlessness.

3. ACTIVITIES UNDER VECTOR CONTROL

The activities carried out by the Ministry of Health and the Ministry of Housing and Local Government are as follows:

House Inspection:- House and premises inspection for *Aedes* surveillance and 'search and destroy' activities to reduce breeding sites in all premises is carried out regularly by the health personnel.

Fogging:- Fogging is done in areas where a case is reported, outbreak areas and areas identified as high risk (high density of *Aedes* mosquito).

Larviciding:- Larviciding, e.g., with temephos to destroy larval stages of *Aedes* mosquito is also carried out by the health personnel.

Enforcement of Destruction of Disease Bearing Insects Act, 1995:- Enforcement of law for those found breeding *Aedes* mosquitoes within their premises is usually taken as a last resort to uncooperative members of the public in the gazetted areas

after all efforts on health education in the need to destroy all potential breeding places of *Aedes*, have failed.

4. OTHER ACTIVITIES UNDER DENGUE CONTROL

Health Education:- Health Education is being intensified in order to gain public support and co-operation. Activities are carried out through mass media and individual approach. Examples of these activities include exhibitions, dialogue sessions, demonstrations and distribution of pamphlets, posters, etc. A Dengue Education Kit (video documentary, cassette, model on *Aedes* life cycle), 'Plan of Action and Training Module' were developed and distributed to all schools.

Interagency Cooperation and Community Participation:- The Ministry of Health and the Ministry of Housing and Local Government are the two Ministries which are directly involved in the prevention and control of dengue. Interagency cooperation in the control and prevention of dengue is being emphasised. The agencies involved are from government, non-government, and voluntary organizations. Amongst others, the government agencies which are actively involved in the control and prevention activities are the Ministry of Information, the Ministry of Education and Local Authorities. "Dengue Free school" programme, a joint collaboration between the Ministry of Health and the Ministry of education was developed in 1994 with the objective of educating the school children in preventive and control activities on dengue who in turn will act as "change agents" in the country. A programme to ensure that the Health Ministry's facilities are free from *Aedes* (*Aedes* Free Health Facilities) has been implemented nation-wide in 1992. This programme was supplemented by another programme called 'Dengue Transmission Free Health Facilities' and operationalized since the middle of 1997.

Non-government agencies such as Resident Associations, Scouts, Red Crescent, Rotary Club, Lions Club and Pest Control Industry are actively involved in anti-dengue activities.

In July 1997, a nationwide anti-dengue campaign was launched involving several Ministries such as Health, Education, Local Government, City Hall Kuala Lumpur, and Information in order to control dengue outbreaks.

Recently in April 1999 another campaign (National Cleanliness and Anti Mosquito Campaign) was launched by the government involving all the revelant ministries with the objective of increasing awareness among all citizens on cleanliness at home, surroundings, work place, public places and its relation to mosquito-borne diseases.

Quality Assurance:- Quality Assurance (Q.A.) as a management tool to improve quality of care in controlling outbreaks was introduced in 1994. Appropriate Q.A. indicators were developed such as 'Notification Time Index', 'Outbreak Control Index' and 'Dengue Law Enforcement Index'.

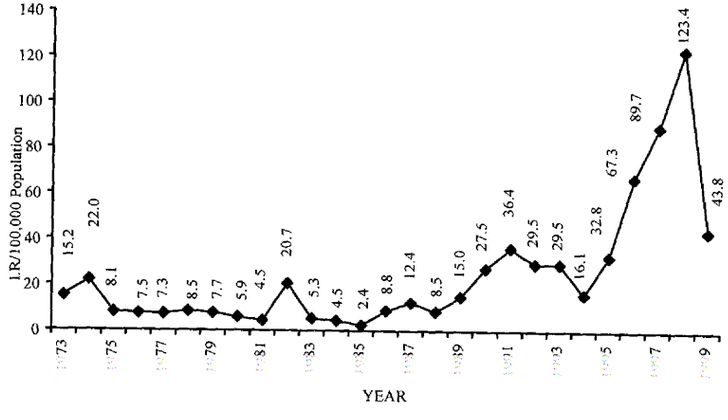
Training:- Training courses are conducted both locally and at international level on a regular basis to update medical and paramedical personnel on various aspects of the control programme.

Research:- Dengue has been identified as one of the priority areas under the Intensification of Research Priority Areas (IRPA) for medical sectors. A study on promoting behavioural changes in the control of dengue and dengue haemorrhagic fever in Malaysia funded by IRPA was initiated in 1996.

5. CURRENT STATUS

Dengue is an endemic disease occurring throughout the country with maximum number of cases reported during the months of July, August and September. The incidence rate of dengue from 1973 to 1998 is as shown in Figure 1. From 1998 the number of cases reported showed an upward trend except for a slight drop in the number cases notified in 1994. The reasons for this increase is due to the period of rapid urbanization and population growth (both local and foreign migration to cities), a different life style (throwing of non-biodegradable containers), rapid transportation and poor living conditions (poor water supply and poor scavenging services at squatter areas). All these gave rise to increased breeding areas for the *Aedes* mosquitoes and the easy spread of the virus.

Figure 1: Incidence Rate of Reported Dengue in Malaysia (1973 – 1999)

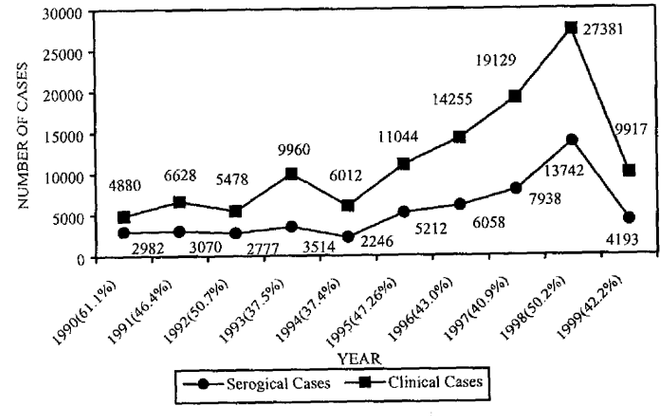


In 1999 there was a drop in I.R. to 43.8 per 100,000 population from 123.4 per 100,000 population in 1998. One of the reasons for this drop is due to the successes of the 'National Cleanliness and Anti-mosquito Campaign' launched in April 1999 with the objective of increasing awareness among all citizens on the cleanliness at home, work place and surroundings and its relationship to mosquito-borne diseases.

Another reason for the reduction of cases is the predominance of Dengue 2 virus for the last few years, contributing to the herd immunity to this virus.

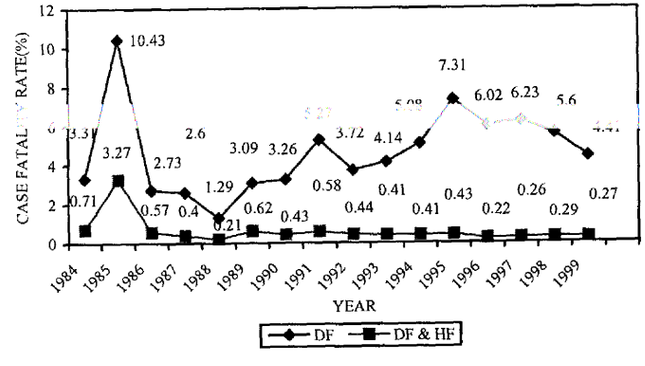
Serological examination has been decentralised to most hospitals after 1993 with the introduction of test kit Dot Enzyme Immuno Assay (IgG) and the IgM test kit in 1996 for all hospitals to further improve on serological confirmation. The proportion of serological positive cases of dengue fever and dengue haemorrahagic fever over reported cases based on clinical diagnosis, ranges from 37.4% to 61.6% with an average of 45.7%. (See Figure 2)

Figure 2: Distribution of Clinical and Serologically Positive Cases of Dengue in Malaysia, 1990 - 1999



The case fatality rate for combined dengue fever and dengue haemorrhagic fever is low but the case fatality rate for dengue haemorrhagic fever alone is quite high though there has been a decline in 1999 (4.41%) compared to 1998 (5.6%). (See Figure 3)

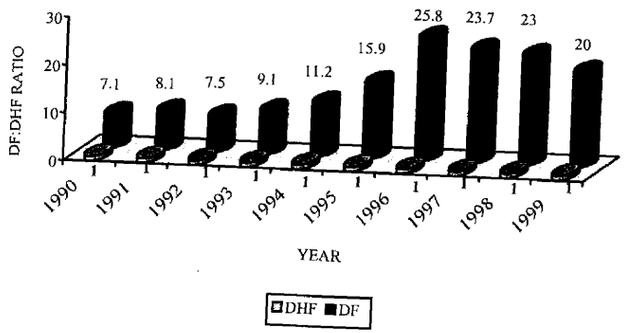
Figure 3: Dengue Case Fatality Rate According to DF/DHF and DHF in Malaysia, 1984 - 1999



All the states in the country are affected. The majority of the cases are confined to the more developed and highly populated states but there is a changing trend where more and more cases are being reported from less problematic dengue states like Perlis, Kedah, Pahang, Terengganu, Kelantan and Sabah. For example the number of cases contributed collectively by the 6 states mentioned above were 1,594 cases (11.2%) in 1996, 2,745 (14.1%) in 1997, 8,101 cases (29.6%) in 1998 and 2,787 (28%) in 1999. (Appendix 3)

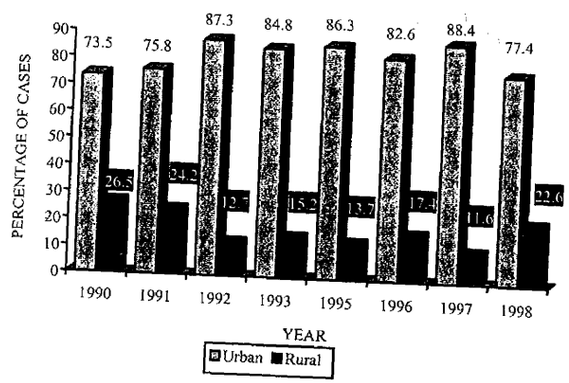
There appears to be an increase in the number of DF cases as compared to DHF as shown in Figure 4. It is believed that there is under-reporting of DHF as in the early febrile phase DHF is indistinguishable from DF and therefore notified as DF.

Figure 4: Distribution of Cases by DF:DHF Ratio, in Malaysia 1990 – 1999



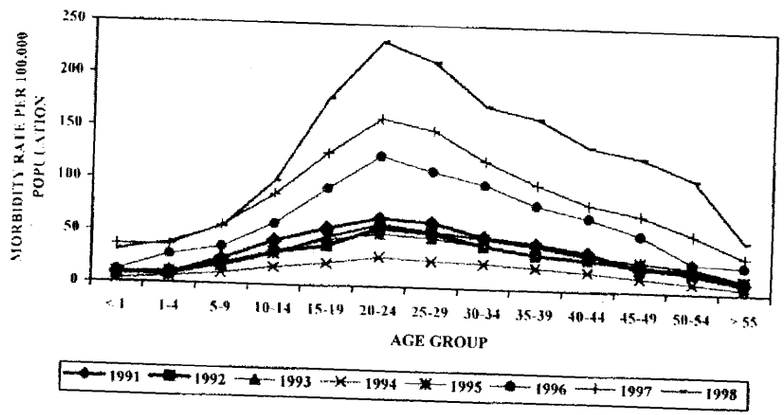
DF and DHF occur mainly among the urban population with an average of 82% of the total cases per year. (Figure 5)

Figure 5: Percentage Distribution of Dengue Cases by Locality in Malaysia, 1990 - 1998



Most of the reported cases are from the middle age group as shown in Figure 6. This is the age group which goes out to work in construction sites, factories, government and private offices. The high incidence rate in the school going age group appears to correlate with the relatively high *Aedes* index in schools. This is in contrast to the low incidence rates among the age groups below 4 years old and above 55 years who are usually at home where the *Aedes* index is less than 1 %. Previously (early 60's and 70's) pre-school children and elderly at home were the main affected groups since the mosquito is a day biter and this group is at home during daytime when A-I for houses was high.

Figure 6: Age-specific Morbidity Rate, 1991 – 1998



There are more males than females reported for DF and DHF ranging from a ratio of male: female 1.1:1 to 1.3:1. The majority of the outbreaks in the country show an equal distribution between male and female. (Table 1)

Table 1: Distribution of Cases by Sex for Malaysia (1992 – 1998)

Sex	1992	1993	1994	1995	1996	1997	1998
Male	3,019	2,942	1,750	3,501	7,906	10,561	15,213
Female	2,454	2,673	1,371	3,042	6,349	8,868	12,168
Ratio M:F	1.2:1	1.1:1	1.3:1	1.2:1	1.2:1	1.2:1	1.3:1

The ethnic distribution of the cases is shown in Table 2. The majority of the cases are among the Chinese, followed by the Malays, the Indians and others.

Table 2: Percentage Distribution of Cases by Ethnic Group in Malaysia (1992-1998)

Ethnic Group	1992	1993	1994	1995	1996	1997	1998
Malay	36.6	36.7	39.0	39.8	46.97	49.6	55.9
Chinese	48.7	47.6	43.1	42.4	40.09	35.2	31.0
Indians	5.4	6.1	6.3	7.9	8.15	8.0	8.1
Others	9.3	9.6	11.6	9.9	4.79	7.2	5.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

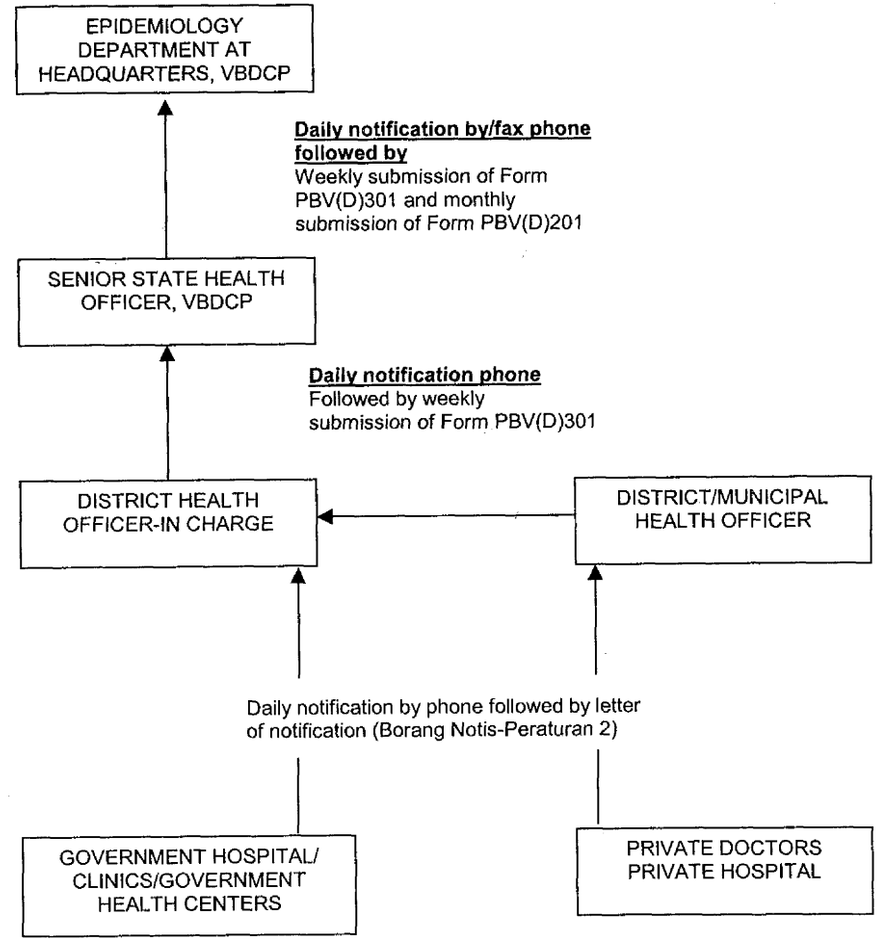
Sentinel virological surveillance within Klang Valley shows Dengue 3 to be predominant in 1993, 1994 with increase in Dengue 2 virus in 1995. In 1996 the predominant virus was both Dengue 1 (48.7%) and Dengue 2 (48.7%), while in 1997 it was Dengue 1 (64%). In 1998 the predominant virus was Dengue 2 (51.9%) followed by Dengue 1 (44.4%) and in 1999 it was Dengue 2 (69.2%).

6. CONCLUSION

Dengue will be a great challenge in future with newer initiatives like reprioritization of areas and targets under *Aedes* surveillance, the scope of search, mass-abating, sequential fogging, use of synthetic pyrethroids, personal protection, increase in enforcement activities, improvement in health education and greater community/inter-agency involvement being given the emphasis.

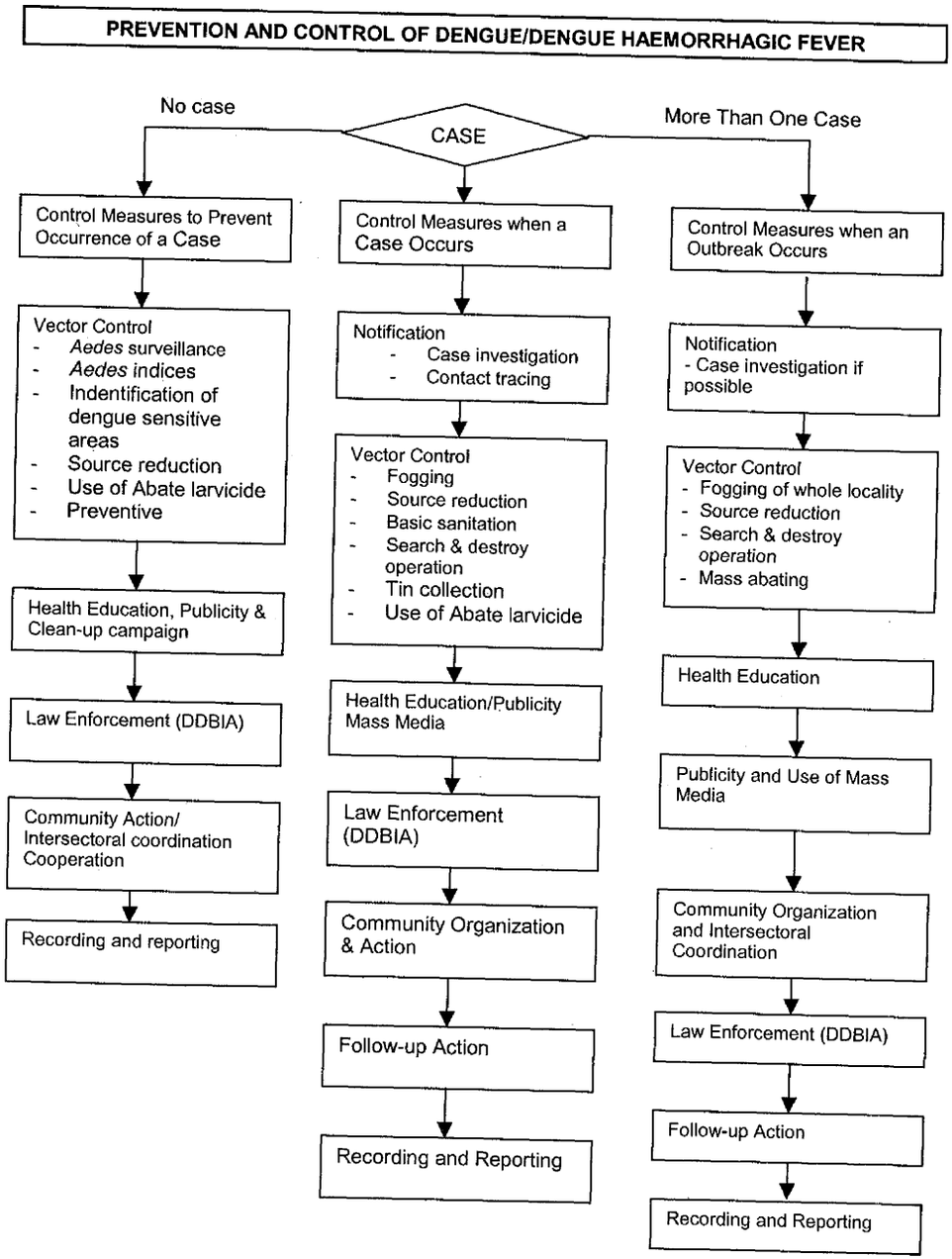
Appendix 1

Example of Notification of Dengue Fever/Dengue Heamorrhagic Fever Through the Proper Channels Under the Vector-borne Disease Control Programme (VBDCP) in Malaysia



For City Hall, Kuala Lumpur (CHKL), Cases from hospital are notified straight to CHKL, which in turn will notify VBDCP

Appendix 2



Appendix 3

Number of Cases, Incidence Rates and Percentage Distribution of Reported Cases of DF/DHF by States in Malaysia 1996 – 1999

States	1996	1997	1998	1999
	Number of Cases (%)	Number of Cases (%)	Number of Cases (%)	Number of Cases (%)
Perlis	38(0.3)	39(0.2)	59(0.2)	46(0.5)
Kedah	134(0.9)	532(2.7)	2.097(7.7)	791(8.0)
Penang	283(1.9)	840(4.3)	692(2.5)	585(5.9)
Perak	683(4.8)	1,007(5.1)	1,477(5.4)	1,047(10.5)
Selangor	4,153(29.1)	4,919(25.3)	5,150(18.8)	1,950(19.6)
Kuala Lumpur	5,123(35.9)	6,088(31.3)	7,340(26.8)	1,319(13.3)
N.Sembilan	340(2.4)	981(5.0)	1,484(5.4)	427(4.3)
Malacca	72(0.5)	391(2.0)	527(1.9)	229(2.3)
Johore	1,805(12.7)	1,793(9.2)	1,595(5.8)	952(9.6)
Pahang	1,006(7.1)	712(3.6)	2,632(9.6)	731(7.3)
Terengganu	174(1.2)	560(2.8)	2,060(7.5)	433(4.4)
Kelantan	109(0.8)	585(3.0)	1,029(3.8)	442(4.4)
Sabah	133(0.8)	317(1.6)	233(0.9)	344(3.5)
Sarawak	222(1.6)	665(3.4)	1,004(3.7)	651(6.5)
Malaysia	**14,255(100)**	**19,429(100)**	**27,373(100)**	**9,947(100)**

ISSUES AND CHALLENGES IN *AEDES* SURVEILLANCE AND CONTROL

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1. INTRODUCTION

Dengue and dengue haemorrhagic fever are major public health problem in Malaysia. There was a dramatic increase in the number of dengue cases from 1995 until 1998. In 1995 a total of 6,543 cases were reported and this figure shot up to 14,255 cases in 1996, an increase of 117.9%. In 1997 a total of 19,429 cases were reported, an increase of 36.3% over the 1996 figure. In 1998 a total of 27,381 cases were reported, an increase of 40.9% over the 1997 figure. In 1999 a total of 9,947 cases were reported, a decrease of 63.7% over the 1998 figure (Table 1). The dramatic reduction in dengue cases in 1999 was mainly due to the National Anti-mosquito and Cleanliness Campaign and the greater awareness of the public during the Japanese Encephalitis outbreak.

Table 1: Dengue Fever Cases in Malaysia (1995 – 1999)

Years	Number of cases	Number of Deaths	Incidence Rate Per 100,000 population
1995	6,543	28	32.93
1996	14,255	32	67.34
1997	19,429	52	89.68
1998	27,381	82	123.43
1998	9,947	27	43.91

Source: Annual Reports, Vector-borne Disease Section, Ministry of Health Malaysia

The two main mosquito vector species, incriminated in the transmission of dengue fever in Malaysia are *Aedes aegypti* and *Aedes albopictus* (Rudnick, 1983). The two species are house frequenting and are found in and around human habitations. They breed in artificial and natural containers and receptacles which hold clean and clear water. Containers such as ant traps, earthen jars, flower pots, drums, buckets, basins, bowls, coconut shells and rubber tyres are some of the preferential breeding sites (Cheong,1967 Lee, 1987). During the routine larval surveys carried out by the district dengue control teams some neglected and unusual breeding sites are detected.

Among these are cocoa pods, septic tanks, abandoned housing projects, roof gutters, refrigerator trays, vacant land, cemeteries and construction sites.

Lam & Dharmaraj in 1982 found *Aedes* larvae breeding in septic tanks. In 1998 Mohamad Anuar and Junaidden examined 295 septic tanks and found 129 (43.7%) were positive with mosquito breeding. However, only 2(1.6%) were found breeding *Aedes albopictus*. There has been report of *Aedes* breeding in construction sites. In 1995, a survey of 1129 construction sites indicated 230 (20.4%) of them were positive for *Aedes* breeding. In 1996 a total of 4,913 construction sites were inspected and 1,169 (23.8%) were positive. Hence construction sites contribute significantly to *Aedes* breeding. The main breeding sites in construction sites are the flooded basement, lift shafts, foundation pits, cement mixers, drums and wheelbarrow.

Both *Aedes* species are generally day-time biters and are active during the day. During the day, both mosquitoes have peaks of landing and biting activity. Macdonald (1956) observed 2 such peaks, i.e., just after sunrise and just before sunset. Lim (1979) found that the highest landing and biting frequency of *Aedes albopictus* was at 1800 h. The morning peak varied and occurred at 0600, 0800 and 1000 h. More recently, Kamilan (1995) reported that the peak biting time of *Aedes albopictus* occurred at 0915-0930 and at 1815-1830. Abu Hassan et al. (1996) also found that the first peak of biting of *Aedes albopictus* occurred at about 1 hour after sunrise and reached another peak before sunset. Hence, it is obvious that both species are day-biters and there has been no behavioural changes in term of biting activities in Malaysia. While *Aedes aegypti* remains biting mainly indoors, *Aedes albopictus* bites both indoor and outdoor. As there is no specific treatment for dengue at the moment, vector control against the *Aedes* mosquitoes is given emphasis in the dengue control programme (Tham, 1993).

The objectives of the dengue control programme are firstly to reduce the breeding of *Aedes* mosquitoes to a level of below 1% *Aedes* House Index and below a Breteau Index of 5, secondly to promote public support and community participation in the prevention and control of dengue and thirdly to get the full participation of the local authorities in dengue control activities Vector-borne Disease Control Programme (VBDCP), 7th Malaysia Plan (1996-2000). The objectives of vector control on the other hand are to reduce the density of vectors and to reduce man-vector contact. During outbreaks, the role of vector control is to prevent the spread of the disease by killing the infected and infective vectors.

The strategies employed in vector control are directed both at the larval and adult stages of the *Aedes* mosquitoes. For larval control, the activities carried out are environmental management measures, source reduction measures, use of Abate larvicide, regular house inspection and the enforcement of the Destruction of Disease Bearing Insects Act, 1975. For adult control, fogging activities are instituted as soon as a case of dengue is notified. The use of household pesticides by the public also helps to reduce the adult mosquito population to a certain extent. The use of personal

protection measure such as mosquito nets, repellents and screening of windows and doors are being encouraged.

The main aim of this paper is to discuss some of the issues and challenges in *Aedes* surveillance and control.

2. *AEDES* SURVEILLANCE AND CONTROL

2.1 House Inspection for *Aedes* Breeding

Since the launching of the Dengue Control Programme in 1974, house inspection has been the main strategy employed for the detection of *Aedes* breeding in and around the houses. House inspection is carried out daily by the district dengue control team and also by the local authority who has its own teams. The purpose of the house visitation is to educate the people on ways and means to prevent *Aedes* breeding including the proper use of Abate larvicide and looking for *Aedes* breeding in individual households. Another reason of house visits is to ensure that the house owner carries out source reduction measures. The results of the *Aedes* larval surveys can be used to assess regularly the *Aedes* situation and to pin point high risk areas so that their areas can be identified as priority areas for control. Usually one full district dengue control team comprises 2 public health assistants, 3 larvae collectors and 4 labourers. The full team is again subdivided into 4 sub-teams. Each sub-team is expected to inspect 50 houses in a day for larval breeding.

For the past 5 years an average of 4,436,025 houses and premises were inspected for *Aedes* breeding. Of these 38,490 (0.87%) houses and premise were positive for *Aedes* breeding. Table 2 indicates the house inspection activity from 1995 until 1999. Although we have managed to control the *Aedes* House Index to a level of around 1%, the incidence of dengue continued to climb from 6,543 cases in 1995 to 27,381 cases in 1998. From here it can be reasoned out that the *Aedes* House Index is not a sensitive indicator and thus not a reliable one for assessing *Aedes* activity and it does not correlate with the incidence of dengue. Another possible reason is that *Aedes* mosquitoes are effective vectors and can maintain the transmission of dengue even at low levels of *Aedes* density. The enforcement of the Destruction of Disease Bearing Insects Act 1975 is also carried out during house inspection. The presence of a single larva in a single breeding site or container in the house is sufficient to enforce the Act. Therefore there is a possibility that other breeding sites are not checked and the emergence of the adult mosquitoes later will contribute to outbreaks.

Table 2: House/Premise Inspection for *Aedes* Breeding (1995 – 1999)

Years	Number of premises inspected	Number of Premises found positive	*Aedes* House/Premises Index(%)
1995	4,555,906	43,773	0.96
1996	4,239,489	41,612	0.95
1997	4,397,754	42,902	1.01
1998	5,071,478	36,203	0.71
1999	3,915,499	27,961	0.71

Source: Annual Reports, Vector-borne Disease Section, Ministry of Health Malaysia

Some of the issues encountered in house inspection are the poor coverage and inadequate visits to the houses. Since only one dengue control team is provided for one health district, only 200 houses can be inspected in a day. Therefore for a health district with an average population of 200,000 and 40,000 houses, it would take 7 months for all the houses to be inspected and before its time to re-inspect the same house. Since the life cycle of the *Aedes* mosquito is only one week, it is obvious that the services provided by the health department is grossly insufficient.

This is compounded by the fact that only 46% of all local authorities have their own dengue control teams thus leading to poor coverage of premises. The mushrooming of new housing estates in recent years is another big problem. The presence of newly discovered and neglected breeding sites such as construction sites, vacant land, roadside dumping sites, cemeteries, abandoned housing projects are additional sources of *Aedes* breeding which will trigger the outbreaks of dengue. In order to improve the coverage and frequency of *Aedes* house inspection a number of new initiatives have been adopted such as

- The number of dengue teams by health district will be reviewed in line with the increase in the number of houses in the districts.
- The local authority especially the large Municipalities will be requested to form its own vector control unit while in the smaller district councils the local health offices will continue to assist in the *Aedes* work.

Out of the 113 district councils only 44 have their own dengue control teams while the 69 don't have dengue teams. There are plans for the Ministry of Health to be responsible for dengue control activities in 52 of the district councils. This will incur additional manpower, fogging machines, insecticides and other resources. Other proposed actions include:

- The State Entomology Teams will carry out assessment surveys to check the quality of work of the district dengue teams in *Aedes* survey.
- Training on public relations is planned to improve rapport with house owners.
- To develop a more sensitive and effective method for surveillance by utilizing the ovitraps. Ovitraps will be placed in selected sentinel areas to monitor and evaluate the effectiveness of *Aedes* house inspection and vector control activities.
- A new policy for dengue control has been approved since 1998 to further strengthen the dengue control activities. A total of 130 dengue sub-teams have been approved to strengthen the dengue teams in 8 health districts from 1998 – 2000. (Table 3)
- To review the norm of the district dengue control team based on the expanded scope of *Aedes* inspection.

Table 3: Allocation of Dengue Sub–teams in Dengue Problem Districts 1998 – 2000

District	Year			Total
	1998	1999	2000	
Gombak	6	6	6	18
Petaling	10	13	14	37
Hulu Langat	3	0	0	3
Klang	7	8	8	23
Port Dickson	3	0	0	3
Johor Baharu	5	6	6	17
Kuantan	6	7	7	20
Kinta	3	3	3	9
Total	**43**	**43**	**44**	**130**

Source: Vector-borne Disease Section, Ministry of Health Malaysia

3. REPRIORITIZATION OF AREAS FOR *AEDES* SURVEILLANCE AND CONTROL

Prior to 1995 the main thrust of *Aedes* inspection is in and around houses where other areas are neglected. Analysis of dengue outbreak reports indicated that cases occurred in areas of low *Aedes* indices and investigations revealed heavy breeding outside houses and in places of occupation of patients. There were also reports of dengue outbreaks in schools, hospitals and cases reported in houses traced to *Aedes* breeding in and near construction sites.

Following a directive to expand *Aedes* surveillance to other areas besides houses, heavy breeding was detected in rubbish dump sites, vacant land, cemeteries, abandoned housing projects, factories, children playgrounds and health facilities. Among the reasons for the dispersal of *Aedes* to other areas may be due to the aggressive vector control activities by health staff and house owners. Following the discovery of the various new breeding sites, a reprioritization programme for *Aedes* surveillance was formulated in 1997 to replace the old plan (Tham, 1997). Appendix I shows the old plan for priority areas and Appendix II shows the new plan. The old plan comprises 4 priority areas while the new plan consists of only 3 priority areas.

In the new plan for surveillance, Priority I areas for the *Aedes* surveillance are those areas with dengue outbreaks, urban areas with large number of construction sites and areas with high *Aedes* density. Priority II areas are those areas with urban setting with a single case of dengue but with high *Aedes* density and in areas with high human concentration such as schools, hospitals and factories. Lastly, Priority III areas are mainly the rural areas without dengue cases but with high *Aedes* density such as plantations, estate, vacant land, rubbish dumping site and cemeteries. The order or level of priority areas for a specific locality in any district is not static. It depends on the dengue situation and *Aedes* indices in a specific locality or facility. For example in 1995 *Aedes* inspection was focused on the construction sites where 1,129 sites were inspected and 230 sites found positive giving an *Aedes* Premise Index of 20.4%. The number of construction sites inspected increased to 32,871 in 1998 and 2,647 were found positive giving an *Aedes* Premise Index of 8.0% (Table 4). The reduction of the index was due to the various control measures instituted in the construction sites and the issuance of a comprehensive guideline for *Aedes* control at construction sites in 1997 (VBDCP, 1997)

Table 4: *Aedes* Surveillance in Construction Sites (1995 – 1999)

Year	Number of Construction Sites Inspected	Number of Construction Sites found positive	*Aedes* Premise Index (%)	Number of Construction sites Closed
1995	1,129	230	20.4	0
1996	4,913	1,169	23.8	0
1997	12,317	1,922	15.6	265
1998	32,871	2,647	8.0	115
1999	13,837	731	5.3	73

Source: Annual Reports, Vector-borne Disease Section, Ministry of Health Malaysia

In the new plan of action for *Aedes* Surveillance, targets were given to the district dengue teams to inspect the various facilities for *Aedes* breeding. In the outbreak areas, 50% of houses/shops, 60% construction sites, 50% clinics/hospitals, 30% schools and 30% factories from the total number of premises for each type will be targeted for *Aedes* inspection. (Appendix III). For each survey area, a checklist of all the breeding sites will be given in order to ensure all breeding sites are checked.

In 1999, a total of 3,915,499 premises were inspected for *Aedes* breeding out of which 23,016 (82.3%) premises were from houses/shops. However it was noted that the positively rate from houses/shops were only 0.6%, i.e., 23,016 positive houses out of 3,736,236 houses searched. In comparison although construction sites searched comprised only 2.6% of the total premises searched, 5.3% of the construction sites had breeding. Likewise although a small number of schools, factories and dumpsites were inspected, the percentage positive or premises indices for these areas were very high. Therefore there is a need to increase the inspections in these areas and to reduce the inspections in houses/shops (Table 5).

Table 5: *Aedes* Inspection in Priority Areas 1999

Types of Premise	No. Inspected	% Total Inspected	No. Premise +ve	%	Premise Index(%)
House/Shops	3,736,236	95.4%	23,016	82.3%	0.6%
Construction Sites	13,837	0.4%	731	2.6%	5.3%
Schools	24,358	0.6%	858	3.1%	3.5%
Factories	15,827	0.4%	863	3.1%	5.5%
Govt. Office	5,351	0.1%	98	0.4%	1.8%
Abandoned Projects	8,043	0.2%	135	0.5%	1.7%
Place of Worship	6,293	0.2%	61	0.2%	1.0%
Cemeteries	1,528	0.04%	65	0.2%	4.3%
Rubbish Dumpsites	8,235	0.2%	496	1.8%	6.0%
Vacant Land	11,578	0.3%	527	1.9%	4.6%
Health Facilities	16,394	0.4%	103	0.4%	0.6%
Road Barricades	4,692	0.1%	39	0.1%	0.8%
Children Playground	3,687	0.1%	156	0.6%	4.2%
Others	59,440	1.5%	813	2.9%	1.4%
Total	**3,915,499**	**100.0%**	**27,961**	**100.0%**	**0.7%**

Source: Vector-borne Disease Section, Ministry of Health Malaysia

4. FUTURE DIRECTION

House and premises inspection are the main strategy for *Aedes* surveillance in the dengue control programme. A reprioritization plan has been formulated to include and expand the scope of *Aedes* inspection to cover other facilities. The current indices used for *Aedes* surveillance are not sensitive and accurate for forecasting outbreaks. The recent studies by the Institute for Medical Research (IMR) indicated a direct correlation between the ovitrap index, rainfall and the occurrence of dengue cases. This may form the basis of an early warning mechanism for the prediction of dengue outbreaks. In the long term the Geographical Information System (G.I.S.) will be used to develop an effective *Aedes* monitoring system taking into consideration

Aedes population (ovitrap index), dengue incidence and other epidemiological, climatic and human population parameters.

5. CONCLUSION

The prevention and control of dengue depend primarily on an effective *Aedes* surveillance system. For this purpose house and premise inspection for *Aedes* breeding must be carried out effectively, completely and to ensure all premises are checked. This is indeed a big challenge since there are so many types of *Aedes* breeding premises and for each premise there are so many breeding habitats both ornamental and structural. The community and the health teams must work in partnership to ensure that the surroundings and premises are free and safe from *Aedes* breeding places.

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12. Vector-borne Diseases Control Programme (VBDCP)
7th Malaysia Plan (1996 – 2000).

13. Vector-borne Diseases Control Programme (VBDCP)
Guidelines For The Control of *Aedes* mosquitoes at construction sites.

Appendix I: Old Plan - Priority Areas for *Aedes* Surveillance and Control

Priority I : Localities where an outbreak or a case of dengue has occurred in the past

Priority II : Localities with 'urban conurbation' and with high *Aedes* Index (A1) and/or Breteau Index (BI). (AI $\geq$ 5%, BI $\geq$ 20)

Priority III : Areas with 'urban conurbation' – but with low *Aedes* Indices. (AI $\leq$ 5%, BI $\leq$ 20)

Priority IV : Rural areas where there are no cases of dengue and low *Aedes* Indices.

Source: Vector-borne Disease Section, Ministry of Health Malaysia

Appendix II: New Plan - Priority Areas for *Aedes* Surveillance and Control

Priority I
- Localities with outbreak / cluster of dengue cases.
- Urban areas with large number of construction sites.
- High *Aedes* density.

Priority II
- Urban areas with single dengue case.
- Urban areas with high *Aedes* density.
- High human concentrations such as hospitals, schools and factories.

Priority III
- Rural areas / semi urban without dengue cases but with high *Aedes* density such as vacant land, rubbish dumping sites, cemeteries, etc.

Source: Vector-borne Disease Section, Ministry of Health Malaysia

Appendix III: Reprioritization of Areas for *Aedes* Surveillance

NO	*AEDES* SURVEY IN...	PRIORITY I	PRIORITY II	PRIORITY III
		(PERCENTAGE OF TOTAL NUMBER OF PREMISES PLANNED FOR *AEDES* SURVEY)		
1.	House/Shops	50%	30%	20%
2.	Construction Sites	60%	30%	10%
3.	Hospitals/Clinics	50%	30%	20%
4.	Schools	50%	30%	20%
5.	Factories	30%	60%	10%
6.	Vacant Land	10%	30%	60%
7.	Rubbish Dumping Sites	10%	30%	60%
8.	Cemeteries	10%	30%	60%

Source: Vector-borne Disease Section, Ministry of Health Malaysia

HEALTH EDUCATION IN DENGUE CONTROL

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1. INTRODUCTION

Health education is one of the major strategies used in the control of Dengue and Dengue Haemorrhagic Fever (DHF) in Malaysia. Since the establishment of the Dengue Control Programme in 1973 under the Health Services Division of the Ministry of Health, health education has been implemented to fulfill the following objectives:

- To educate the general public about the facts of the disease such as the causative agent, vector, signs and symptoms, mode of transmission, *Aedes* breeding sites, prevention, control and importance of early treatment.
- To obtain public support and cooperation in dengue prevention and control.
- To promote the use of larvicide (such as Abate) and to instruct the public on the proper use of this larvicide.
- To inform the public about the dengue control laws Destruction of Disease Bearing Insect Act, 1975 (DBBIA) and its enforcement.

2. EDUCATION ACTIVITIES AND MATERIALS

The focus of dengue health education activities is in endemic and dengue prone areas. Health education activities are routinely carried out during household inspection and *Aedes* surveys. These activities include giving advice, demonstration on the use of Abate, and distribution of dengue leaflets and flyers. Education activities are also conducted for the public and specific groups at places such as schools, health centres, factories and housing estates. These activities are usually in the form of talks, dialogues/discussions, exhibitions, film/video shows and distribution of education materials. The number of education activities conducted for dengue prevention and control for the years 1995 – 1999 are given in Table 1.

Education materials on dengue are also produced regularly to support education activities. These include audio-visual aids like slides and video tapes and also models. Large quantities of printed materials like posters, leaflets, booklets, stickers and flipcharts are also produced at the national and state levels. The number of educational materials produced annually are given in Table 2.

Table 1: Health Education Activities in Dengue Control, Malaysia 1995 – 1999

ACTIVITY	NUMBER				
	1995	1996	1997	1998	1999
Talks	10,612	8,036	4,311	25,132	15,676
Dialogues	1,773	1,422	2,402	37,060	31,271
Exhibitions	606	924	621	1,173	1,344
Demonstrations (Use of Abate)	113,686	101,024	59,544	309,961	400,007
Film shows	681	4,137	776	697	3,842
Small group discussions (during *Aedes* Surveys)	438,742	566,265	152,788	518,568	11,008,388
Public announcements	1,272	6,842	1,504	5,581	26,109
Poster distribution	17,397	24,018	43,895	35,628	849,794
Pamphlet distribution	251,790	566,744	946,678	907,418	34,074

Table 2: Production of Health Education Materials on Dengue, Ministry of Health Malaysia, 1995 – 1999

TYPE OF MATERIAL	YEAR				
	1995	1996	1997	1998	1999
Leaflets/flyers	45,700	NA	900,000	1,850,000	10,000
Posters	6,550	NA	-	190,000	10,000
Booklets	18	NA	-	-	-
Flipchart	230	NA	-	-	-
Stickers	-	NA	-	-	10,000
Car stickers	-	NA	-	-	5,000
TV slide	-	NA	1 type	-	-
TV trailers	-	NA	3 titles	-	-
Video documentary	-	NA	-	1 title (30 copies)	1 title (500 copies)

NA: Not available

3. CAMPAIGNS

Public campaigns on dengue are carried out particularly when there are outbreaks of dengue nationwide. During campaigns, education activities are intensified, with

greater utilisation of the mass media. At the same time, there is greater intersectoral collaboration with relevant government agencies and also greater community involvement.

3.1 The 1997 Anti-dengue Campaign

Statistics reported by the Vector-borne Disease Branch of the Ministry of Health showed that there was a dramatic increase in dengue cases of 37.1% in 1997 (19,544 cases) compared with 1996 (14,255 cases). The incidence rate of dengue was 89.67/100,000 population for 1997 compared with 67.34/100,000 population for 1996.

This outbreak was even more dramatic around mid-1997 when the anti-dengue campaign was planned. The cumulative number of dengue and Dengue Hemorrhagic Fever (DHF) cases reported till 12 July 1997 (epidemiological week 28/97) was 10,296 compared with 5,120 cases for the same period in 1996. This was an increase of 101% over the same period. At that time, the states reporting the highest increases in dengue cases were Federal Territory of Kuala Lumpur (36.6% increase), Selangor (28.4%) and Johore (8%). Among the reasons given for the outbreak were:-

- There were many *Aedes* breeding places especially in construction sites, abandoned housing projects, illegal dump sites, schools, factories and offices, and

- Lack of involvement and co-operation of individuals and the community in the prevention and control of *Aedes* breeding in their homes and work places.

The Health Education Division of the Ministry of Health was requested to plan and implement a health education programme to control this outbreak. One of the first actions of the division was to develop a plan of action which was then circulated to all states for implementation. This plan of action provided a situational assessment and a framework of objectives, target groups, strategies, educational activities and monitoring.

The specific objectives of this campaign were to:

Increase the knowledge of the general public concerning dengue, the causative agent and vector, prevention and control.

- To motivate the community to eliminate *Aedes* breeding places.
- To obtain public support and co-operation in dengue control efforts.
- To encourage individuals to seek early treatment if they have the signs and symptoms of dengue.

The major strategies used in this campaign were:

- Communication strategy which involved the use of the mass media, publicity activities, interpersonal communication by the health staff and the distribution of educational materials such as posters, leaflets and booklets.

- Training or skills development for health staff, teachers, staff of other government agencies, office workers and workers at construction sites.

- Intersectoral collaboration. The Ministry of Health and the Ministry of Housing and Local Government are the 2 ministries that are directly involved in the prevention and control of dengue. Other ministries or government departments were also involved such as Ministries of Education, Information and Agriculture.

- Community participation. The community in villages, housing estates, schools, workplace and offices were actively involved in cleaning-up operations and destruction of *Aedes* breeding areas. Non-government organisations such as Residents Associations, Scouts, Girls Guides, Red Crescent, Rotary Club and Lions Club also played an active role in the campaign.

Most of the health education activities were planned and conducted at places where there was a lot of *Aedes* breeding such as residential areas, schools, offices, factories, construction sites, places of worship and shopping complexes.

The major target groups for this campaign were:

- The school population.
- Residents of households.
- Management and workers of construction sites.
- Management and workers in factories and shops.
- Office workers.

A summary report of the educational activities carried out at the various target areas from the start of the campaign in July till the end of 1997 is given in Table 3. It shows that most of the educational activities carried out were mainly interpersonal communication activities such as talks, advice giving and small group discussion. Most of the activities were carried out at homes, government hospitals and clinics and schools. Comparatively fewer activities were carried out at construction sites and

Table 3: Dengue Education Activities Carried Out by Location from 27.7.1997 till 3.1.1998

Location / Activity	School		Hospital/ Clinic		Govt. Departments		Private Sector/Shops		Factories		Place of Worship		Construction Sites		Shopping Complex		Residential Premises		Others	
	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.	No.	Att.
Inter-personal communi-cation (e.g., advice-giving, small group discussion etc.)	6458	248,934	7,001	62,031	1,643	11,818	8,844	96,051	5,711	35,536	720	8,485	4,983	16,388	209	2,228	1,006,391	2,017,797	5,291	20,350
Distribution of pamphlets/ flyers	305,672	-	75,482	-	20,367	-	21,884	-	15,641	-	12,291	-	8,289	-	14,741	-	687,429	-	40,976	-
Distri-bution of posters	11,459	-	4,018	-	2,833	-	4,021	-	2,110	-	2,141	-	2,521	-	524	-	51,868	-	2,826	-
Exhi-bitions	411	187,742	241	35,457	21	4,728	9	1,600	30	9,089	28	6,350	5	-	19	6,500	57	16,979	77	46,294
Film/ video shows	230	50,914	236	7,042	7	351	2	350	0	0	23	380	0	0	0	0	34	6,813	18	8,410
'Gotong-royong' activities	432	80,557	239	5,629	86	3,846	87	309	8	392	183	27,372	18	436	2	511	544	29,791	269	13,750
Spon-taneous announ-cements by health education mobile unit	272	-	92	-	32	-	68	-	24	-	97	-	44	-	84	-	8,377	-	823	-
Radio talks	183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28	-	-	-

shopping complexes. No film/video shows on dengue were shown at factories, construction sites and shopping complexes.

The mass media were widely and intensively used during this campaign to create awareness and disseminate information to the general public. A TV slide on how to prevent the *Aedes* mosquito from breeding together with a voice-over (VO) script was sent to all the national TV stations for regular airing starting from July 1997. At the same time, radio spot announcements were made regularly through all radio stations to maintain the public's awareness about the dengue problem. Talks by health experts were also held regularly over radio and TV. By September 1997, the Ministry of Health (Vector-borne Disease Branch) has produced three 40-seconds TV trailers to educate the public on the importance of early detection and treatment, the enforcement of the DDBIA and the elimination of *Aedes* breeding sites. A budget of RM120,000 was provided and the trailers were aired over RTM from 15 October till 31 December 1997. A TV series consisting of 5 episodes were produced and aired over Educational TV of the Ministry of Education to educate school children about dengue prevention and control. At the same time, dengue information was presented in an interactive and multi-media format through a network of information kiosks (called TEMAN). This network of info kiosks was rented by the Ministry of Health to provide comprehensive information on dengue and several other health topics. The kiosks are mainly located in shopping complexes in Klang Valley and some major towns like Ipoh, Malacca, Kuching and Kota Kinabalu. Besides the use of mass media, educational materials and IT, billboards were also utilized in the Klang Valley to create awareness about dengue fever in this campaign.

3.2 Media Campaign in Conjunction with SUKOM 1998

Malaysia hosted the Commonwealth Games for the first time in her history in 1998. The 16th Commonwealth Games (SUKOM) were held in various sports venues in Kuala Lumpur, Selangor, Langkawi and Sarawak from 11 – 21 September 1998. One of the major responsibilities of the Ministry of Health before and during the games is to prevent any epidemic of communicable diseases, particularly dengue fever and food and water-borne diseases. Dengue was still a major health problem at that time and efforts had to be taken to ensure that the disease did not affect the games participants, officials and visitors from abroad. The Health Education Division was given the responsibility and a budget to plan and implement a health education media campaign to prevent dengue outbreaks from occurring during SUKOM.

The dengue media campaign targeted the Malaysian public, particularly:

- Residents of housing areas;
- School population;
- Workers and employers of construction sites; and
- Business premises found in the vicinity of SUKOM venues.

The media activities implemented included:

Production of a video documentary on dengue in Bahasa Malaysia and English. The documentary was aired by the local TV stations before and during SUKOM 98.

- A 60-second radio commercial (RC) on dengue was produced in the 4 major languages. The RCs were aired over Radio 1, 2, 4, 5 and 6 of RTM before and during the games.
- Radio and TV talks on dengue were aired before and during the games.
- Several articles on dengue were published in the major local newspapers and magazines with expert input from officers of the Vector-borne Diseases Control Branch of the MOH.
- A full-page, full colour newspaper advertisement on dengue was published in early September 1998 in 6 major local newspapers (Utusan Malaysia, Berita Harian, New Straits Times, The Star, Nanyang Siang Pau and Tamil Nesan).
- A total of 50 billboards on dengue prevention were erected around SUKOM venues, major cities and tourist destinations.
- A total of 645,000 dengue flyers in Malay, and 361,000 dengue flyers in English, as well as 45,000 copies each of 2 types of dengue posters were distributed to all the states prior to SUKOM. These materials were distributed and displayed at the games village and all SUKOM venues.

The dengue media campaign in conjunction with SUKOM 98 served as a follow-up effort to the dengue campaign of 1997. It helped the public to remain aware of the dengue problem as well remind them of the need to prevent the *Aedes* mosquito from breeding in their homes, schools and workplaces.

3.3 National Anti-mosquito and Cleanliness Campaign

This nationwide campaign was launched by the Deputy Prime Minister on 20 April 1999 at Wisma TV, Angkasapuri. This campaign was conducted because mosquito-borne diseases such as dengue, malaria, filariasis and Japanese encephalitis (JE) have become a major health problem to the population in both the rural and urban areas arising from the apathy of the public towards environmental cleanliness and prevention of mosquito breeding. Therefore, the Cabinet Task Force on JE directed that a major campaign be held with the theme "Maintain cleanliness, destroy mosquitoes". The aim of the campaign is to make the nation clean from rubbish and to eliminate mosquito-breeding sites through intersectoral co-operation and community action so that mosquito-borne diseases can be prevented from occurring. Besides eliminating mosquito breeding sites, other disease vectors like flies, cockroaches and rats will also be eliminated through this cleanliness campaign.

The campaign is very broad-based and covers 19 operational or target areas. These included:

- Schools;
- Markets;
- Food premises;
- Homes and housing areas;
- Agricultural areas and animal farms;
- Rubbish dumps;
- Construction sites;
- Industrial and commercial areas;
- Places of worship.

For the above areas, strategies are designed to achieve the following:

- Free from rubbish through proper rubbish collection and disposal.

- Good drainage with drains maintained in good condition.

- Elimination of *Aedes* breeding sites through inspection of premises, fogging, use of larvicide and '*gotong-royong*' activities.

- Maintenance of a high standard of cleanliness, particularly for food manufacturing and preparing areas/premises.

The main thrust or strategy of the campaign is to mobilize the whole government machinery including appropriate and adequate allocation of human resources, finance and technology to intensify existing sanitation activities. The two lead agencies which are co-chairing the campaign committee are the Ministry of Health and the Ministry of Housing and Local Government. Other ministries and government agencies involved in the campaign include the ministries of Agriculture, Information, Education, Science, Technology and Environment, the Prime Minister's Department and JAKIM (Islamic Development Department). Besides this strategy, other strategies used included the mobilization of the community, voluntary organisations and the private sector, the adoption of the "Healthy City" project in major cities and towns of the country and enforcement of laws such as the DDBIA 1975, the Prevention and Control of Infectious Diseases Act 1988, Food Act 1983 and by-laws of local authorities.

In conjunction with this campaign, many health education activities were planned and conducted. They included:

- The development, printing and distribution of 40,000 posters on elimination of mosquito breeding areas.

- The production and broadcasting of the campaign song in 4 languages.

- Broadcasting of talks on radio (3) and TV (3) regarding the campaign and mosquito-borne diseases.

- The broadcasting of the dengue documentary film over all TV channels.

- The broadcasting of the radio commercial on dengue over all radio channels.

- Publication of newspaper articles on dengue. A total of 10 newspaper articles, 15 news reports and an advertisement in 4 languages were published.

- Co-operation with the private sector to produce educational materials for the campaign including posters, newspaper advertisement and media pack.

Other campaign activities conducted (till 23 October 1999) included:

- Launching of the campaign by 94 local authorities throughout the nation.

- Inspection of premises for *Aedes* breeding. A total of 3,265,876 premises were inspected. Most of the *Aedes* breeding areas were found in cemeteries (12.73%), construction sites (9.88%), rubbish dumps (9.18%), factories (6.99%) and playgrounds (6.78%).

- Fogging was carried out extensively in many premises.

- Many '*gotong-royong*' or community self-help activities were carried out to clean the surroundings of rubbish and mosquito breeding. As many as 1,170 '*gotong-royong*' activities were carried out by the Ministry of Health while 4,662 were carried out by the local authorities.

- Enforcement of health and cleanliness laws.

  Under the DDBIA 1975, owners of premises found harbouring *Aedes* mosquitoes will face enforcement action such as notices, compounds or court action. Till 23 October 1999, a total of 5,505 notices and 11,360 compounds were issued whereas court action on 283 premises were taken. Another 50 premises were closed down.

  Evaluation of the campaign showed that the number of cases of dengue and DHF declined dramatically. There were a total of 17,286 cases till week 42 of 1998, and this declined to 3,995 cases in the same period for 1999, a decrease of 77%. The number of dengue/DHF deaths also declined from 35 in 1998 to 9 for the same period in 1999. The sharp decline in the number of cases and deaths showed the effectiveness of the campaign.

4. DENGUE-FREE PROGRAMME IN SCHOOLS

This programme is an important component of the Health-Promoting Schools (HPS) Programme which is a joint programme of the Ministry of Health and the Ministry of Education. The HPS programme adopts the settings approach advocated by the World Health Organisation (WHO) that seeks to make schools a healthy and safe place for the school community to learn, work and play. The HPS programme consolidates all health activities in schools and is a revival of the School Health Programme. There are 6 core elements of the HPS:

School Health Policy, of which being dengue-free is one important policy.

- Healthy and safe school physical environment, which includes prevention of *Aedes* breeding.
- Healthy and safe school social environment.
- Community action, including cleaning up the school premises and destroying *Aedes* breeding areas.
- Personal health skills.
- School health services, which included early detection of communicable diseases, health education and training.

The Dengue-free Programme in schools was first planned and developed in 1994. It was first implemented in January 1995 and officially launched by the Minister of Education in December 1995. The programme was implemented in 2 phases. Phase 1 was implemented in early 1995 and covered 11 districts with dengue problems while phase 2 was launched in early 1996 to cover all schools in the country.

By the end of 1998, 6,038 schools (64.9%) out of a total of 9,298 schools throughout the country have implemented the dengue-free Programme. A total of 12,844 *Aedes* inspections was carried out in the 6,038 schools in 1998. It was found that 12,247 (95.4%) of these inspections were satisfactory. This programme has succeeded in reducing the occurrence of dengue among children of school-going age (5 – 19 years). Prior to the launch of this programme in 1995, children in the 5 – 19 years age group accounted for at least 32% of all dengue cases in this country. This percentage has decreased to 30.2% in 1995, 29.5% in 1996 and 26.0% in 1997. There was a slight increase to 28.7% in 1998 (Table 4).

Table 4: Number and Percentage of Dengue Case Occurring among Children of School-going Age (5 - 19 Years) Malaysia, 1991 – 1998

YEAR	NUMBER OF DENGUE CASES NATIONWIDE	DENGUE OCCURRING AMONG CHILDREN 5 – 19 YEARS OLD	
		Cases	%
1991	6,628	2,333	35.2
1992	5,473	1,733	32.7
1993	6,615	1,924	34.3
1994	3,133	992	31.7
1995	6,543	1,974	30.2
1996	14,255	4,207	29.5
1997	19,429	5,051	26.0
1998	27,381	7,850	28.7

5. DENGUE-FREE PROGRAMME IN HEALTH FACILITIES

The guide book for this programme was completed at the end of 1996, and the programme was implemented in 1997. In 1998, 4,878 health facilities throughout the country implemented this programme. A total of 1,064 anti-*Aedes* committees and 615 anti-*Aedes* teams were formed. As many as 63 facilities (3.6%) out of a total of 1,738 surveyed were found to harbour the breeding of *Aedes* mosquitoes. There were 3,225 *Aedes* breeding places destroyed.

6. CONCLUSION

Health education remains an important strategy in the prevention and control of dengue. It serves to create public awareness about the disease, educate them about the facts of the disease and its prevention, and promote public action in prevention and control of the disease. Dengue health education should be carried out regularly and routinely in dengue endemic areas through a variety of educational methods and media. At the same time, dengue educational campaigns should be planned and implemented during outbreaks to intensify health education activities and to support dengue control activities. Campaigns have been shown to contribute to the elimination of *Aedes* breeding places and the reduction of dengue cases. Campaigns should be multi-pronged, with extensive use of the mass media, strong intersectoral

collaboration and good community action. The settings approach such as the Health-Promoting Schools can offer an effective and holistic strategy in Dengue prevention. Based on the five pillars of the Ottawa Charter (1986), this approach can help to create a supportive environment for prevention of *Aedes* breeding and community action to eliminate breeding areas. Research, especially in the area of human behaviour, effective health education methods and strategies in dengue prevention, should be conducted to strengthen the theoretical base for future dengue health education programmes.

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LAWS AND LEGISLATION: IMPLICATION ON COMMUNITY PARTICIPATION FOR DENGUE CONTROL

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1. DEFINITION OF LAW

Law is a body of man-made rules or procedures codified or un-codified to regulate the conduct of a community or individual living in a society so that the process of social interaction may run smoothly. A breach of these rules is liable to cause a sanction of some kind on behalf of the community by some law enforcement officers.

At the 1984 ASEAN Law Conference, Datuk Seri Mahathir, in his speech said, "Laws play an important part in protecting the life and limb, liberty and property of the citizen. No man is above the law, not even those in power. Those in power are in fact trustees and their duty is to promote the public good, not self-enrichment".

The late Tun Abdul Razak, in another Law Conference said,

"Law is not something immutable written on tablets of stone but that law is to serve man, not that man should serve the law, though of course he should obey it. Law is a living thing that should be kept under constant review, that it should be brought up to date from time to time so that it will always remain suitable for contemporary needs, so that it can be used as an instrument for satisfying the hopes and aspirations of the people.

Antiquated laws must be constantly reviewed, updated and improved so that it will increase the citizen's opportunities for economic, social and political advancement, create and increase his opportunities for prosperity and happiness".

2. STRATEGY FOR THE PREVENTION AND CONTROL OF DENGUE

The strategy for the prevention and control of dengue is through the integrated approach which includes:-

- Surveillance of *Aedes* mosquitoes;
- Surveillance of the disease; and
- Serological surveys for monitoring the changing trend of the disease.

This operation consists of a campaign lasting for one month which emphasized on community participation including health education, larval surveys and enforcement

of the Destruction of Disease Bearing Insect Act (DDBIA) 1975, to destroy and to prevent *Aedes* breeding. The activities are carried out during the months of January, April, July and October. A summary of the activities for the prevention and control of dengue is given in Figure 1.

3. LAWS AND LEGISLATION ON VECTORS AND VECTOR-BORNE DISEASES

These are vested under:

- Dangerous Disease Bearing Insect Act (1975) - prevention and control measures.
- Prevention and Control of Infectious Diseases Act (1988) - notification, control measure.
- Local Government Act (1976) - mosquitoes as a nuisance.

4. FEATURES OF LAW ENFORCEMENT

The Destruction of Disease Bearing Insect Act (DDBIA) 1975, was enacted on the 2nd of February 1977 and enforced in selected areas. On 23rd August 1982 the legislation was enforcement in all areas in Malaysia.

The Act was meant to control the breeding of all vectors that transmit diseases.

4.1 The Powers and Authority of the Director General and Medical Officer of Health are:

To delegate authority except Sec.25 on compounding of offence.

4.2 Powers and Authority of the Health Inspectors are:

Sec. 5 – Power of entry
Sec. 6 – To collect items implicated in offence
Sec. 7 – To obtain information
Sec. 9 – To obtain assistance from owner/occupier
Sec. 24 – To obtain assistance from police

4.3 The Role and Authority of the Entomologist is:

To issue certificate of entomological report after identification and certification of entomological species to the court as professional evidence.

4.4 Offences

Sec. 7, 8, 9, 11, 12, 13, 14, 20, and 21

Prosecution on Court

The main objective of a prosecutor is to see that justice is done. His reasons for prosecution are as follows:

For the protection of society (i.e., against vector-borne diseases);

- To find out if the accused person is guilty or innocent within the framework of the law;
- To adhere to government policies;
- To redress an aggrieved person;
- To protect the fundamental liberties of a person; and to punish offenders for infringing the law.

Procedure for Court Action

An application is made to the magistrate for a summons against the accused person when an offence has been committed. The applicant is normally an authorised officer. The applicant summits the following documents:

- Letter of application for summons;
- Complaint;
- Summons;
- Charge sheet; and
- Analyst's certificate or other documentary evidence.

5. COMMUNITY PARTICIPATION

5.1 Community-based Activities

Informing the public on laws alone has not empowered the public to voluntarily behave in the ways that will promote healthy lifestyles and prevent diseases.

Voluntary health actions are not likely to take place when people are not fully involved in the planning, implementation and evaluation of public health and health education, in this case, vector (e.g., mosquito) control and the prevention of vector-borne diseases (e.g., dengue).

However, communities tend to leave decision-making and evaluation of the vector control and disease control to specialised health personnel. In the mind of the community, mosquito control is still considered as the responsibility of the health authority. The health authority is empowered to tackle all their vows concerning mosquito problems. Communities do not see their part of the contribution. Actions are always one-sided.

A member of the public may be forced to participate in the prevention and control of mosquito on a very limited scale. For example, an owner of a vacant land is served with a notice ordering him under Section 82 of the Local Government Act, or Section 8 of the Diseases Bearing Insect Act, to clear his land of over-grown vegetation. This will help to clear harbourage for the mosquitoes and clear any unwanted containers thrown on his land that may provide breeding sites. He may be compounded for not complying with the notice.

5.2 Source Reduction Activities

When a health officer carries out the activity of source reduction to seek and destroy mosquito breeding, he also enforces the law concerning Dangerous Diseases Bearing Insect Act. The people found to be breeding mosquitoes are issued with compound notice for the offence (Table 1 and Table 2).

Table 1: House Inspection for *Aedes* Breeding in Malaysia 1995

State	No. of Houses Inspected	No. of Houses Positive for *Aedes*	*Aedes* House Index
Perlis	45,505.00	1,519.00	3.33
Kedah	389,117.00	931.00	0.24
Penang	323,631.00	1,855.00	0.57
Perak	744,548.00	8,040.00	1.08
Selangor	613,816.00	4,721.00	0.77
Kuala Lumpur	110,797.00	1,941.00	1.75
Negeri Sembilan	160,293.00	919.00	0.57
Malacca	163,583.00	616.00	0.38
Johore	587,444.00	5,603.00	0.95
Pahang	216,203.00	1,626.00	0.75
Terengganu	162,496.00	2,037.00	1.25
Kelantan	322,575.00	2,782.00	0.86
Sabah	279,254.00	2,183.00	0.78
Sarawak	436,377.00	9,000.00	2.06
Jumlah	**4,555,906.00**	**43,773.00**	**0.96**

Source: Vector-borne Disease Control Unit, Ministry of Health

After sometime, when the community has learned that the visits of the health personnel mean finding mosquito breeding places and they have been fined for such breeding, the community reacted negatively. About three to five percent of the house owners or occupiers have denied health personnel entry into their homes (Health Department, City Hall Kuala Lumpur (CHKL) - unpublished surveys). Some of them will quickly search their houses and destroy any breeding sites before allowing entry of the health personnel.

We have seen that forty to sixty percent of the houses covered in the search and

Table 2: House Inspection for *Aedes* Breeding in Malaysia 1991-1995

Year	No. of Houses Inspected for *Aedes*	No. of Houses Positive for *Aedes*			*Aedes* House Index			No. of Dengue Cases	No. of Deaths
		A. aegypti	*A. albopictus*	Combined	*A. aegypti*	*A. albopictus*	Combined		
1991	4,178,856	11,269	32,899	44,168	0.27	0.79	1.06	6,628	39
1992	4,306,997	12,861	33,579	46,440	0.30	0.78	1.09	5,473	24
1993	4,822,081	12,946	35,703	48,649	0.27	0.74	1.00	5,615	23
1994	4,724,210	9,295	24,083	33,378	0.20	0.51	0.71	3,133	13
1995	4,555,906	9,425	34,348	43,773	0.21	0.78	0.96	6,543	28

Source: Vector-borne Disease Control Unit, Ministry of Health

destroy operation are closed or are not accessible for health personnel to enter. The result has not improved even when such operations are carried out during a Sunday or public holiday. A lot of manpower, time and money are wasted as the final results in terms of the information related to vector indices in these operations are low and not indicative of the real situation. However, legislative support is essential for frequent and recalcitrant offenders.

5.3 Community Participation Through the Use of Mosquito Larvae Trapping Device (MLTD)

When the Health Department, CHKL came out with an innovative idea of using Mosquito Larvae Trapping Devices (MLTDs), as a new tool in the control and destroying of the *Aedes* mosquitoes in 1997, it was seen as contravening the DDBIA under Section 13 and 14 (allowing the vector to breed). The device was presented to the Vector-borne Disease Control Unit of the Ministry of Health in 1997. They failed to make any positive recommendations for its use. The Health Department of CHKL has used these devices in soliciting community participation. The Institute for Medical Research knew about it but did not request for it to be evaluated. The Vector-borne Disease Control Unit only requested a sample of the MLTD to place it in their vector museum.

5.4 Legislation on Building Structural Plans

Laws can be used as a tool to force some action for community participation in terms of a change in their practices, attitude and behaviour. In one of our neighbouring countries, they have been quite successful in bringing about change by disallowing the use of bathtubs as a permanent structure in the bathroom through their planning act. This has helped indirectly to reduce the possibility of mosquito breeding in houses. Showers have been recommended as a replacement for bathtubs to store water. Perhaps this can be interpreted indirectly as community participation.

5.5 Community Participation in Court Cases

Public participation is possible by being a witness. This is usual in a case of public complaint involving an offence related to public nuisance. However, involvement of the public normally only takes place at the point of channelling the complaint. The sources of complaint are usually anonymous or fictitious. The public do not want to get involved for some reason or another. In the cases concerning DDBIA, a witness from the member of the community rarely takes the stand. Oral evidence and opinion of experts are usually from the authorised officers. Material or real evidence are rarely tendered in court.

The number of cases that go to court are not many. The time from the detection of the offence to the time the case is brought to court may vary from six months to more than one year. The reasons behind this are many. Most of the time it is due to lack of action by the authorised officer to initiate the case to court (Tables 3, 4 and 5).

Table 3: Enforcement of DDBIA in Malaysia 1991-1998

Year	No. of Houses Positive for *Aedes*	No. of Warning Notices Issued	No. of Compounds Issued	Compounding Rate (%)	No. of Court Cases
1991	46,168	14,840	21,074	47.7	224
1992	46,440	13,643	23,475	50.5	114
1993	48,649	14,678	25,990	53.4	102
1994	33,379	15,024	23,075	69.1	38
1995	43,773	18,049	20,253	46.3	48
1996	Data not obtainable				
1997	42,902	19,878	28,834	67.2	989
1998	36,203	17,972	30,696	84.8	298

Source: Vector-borne Disease Control Unit, Ministry of Health

Table 4: Enforcement of DDBIA in Malaysia

State	No. of Notices	No. of Compounds	No. of Court Cases	Amount of Fine Collected (RM)
Perlis	1,431	132	0	1,265.0
Kedah	761	170	0	8,275.0
Penang	53	1,676	0	124,430.0
Perak	2,618	6,264	14	302,690.0
Selangor	1,661	2,852	30	177,120.0
Kuala Lumpur	-	1,524	0	89,541.0
Negeri Sembilan	59	861	0	39,250.0
Malacca	457	158	0	4,497.0
Johore	2,388	3,180	0	178,424.0
Pahang	799	876	4	40,205.0
Terengganu	1,261	100	0	4,805.0
Kelantan	2,271	168	0	6,955.0
Sabah	1,476	684	0	23,231.0
Sarawak	2,814	1,608	0	29,695.0
Jumlah	**18,049**	**20,253**	**48**	**1,030,483.0**

Source: Vector-borne Disease Control Unit, Ministry of Health

Table 5: Vector Control Activities in Kuala Lumpur 1988 - 1998

Activity/Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Promise Inspection	108,629	120,959	149,874	148,066	141,243	225,605	225,605	110,378	121,936	86,833	72,930
Fogging	301,009	763,343	600,982	689,290	325,194	1,240,198	866,075	884,075	568,953	2,399,963	2,545,160
Enforcement DDBIA	2,051	2,029	1,759	2,064	2,416	6,340	6,340	1,596	2,044	2,999	3,393
Fine Collected	112,670	112,670	74,334	74,440	99,815	89,036	-	89,552	138,081	300,770	198,905
Scavenging	1,075	1,075	1,378	1,028	830	1,345	1,066	1,066	1,414	1,439	1,211
Court Cases	0	0	0	0	0	0	0	0	355	171	54
Health Talks	27	2	9	11	16	14	27	27	48	7	20
Slide Shows	303	184	300	128	132	94	31	31	31	7	20
Pemphlets Distribution	11,829	6,869	17,253	4,0019	23,710	29,960	16,545	6,545	22,567	19,007	39,444
Exhibitions	4	8	15	22	34	19	24	-	22	13	20
'Gotong-royong'	NA	5	7	6	7	5	3	3	5	7	12
Person to Person Communication	-	-	-	-	-	-	-	-	108,171	121,936	NA

Source: Vector-borne Disease Control Unit, Ministry of Health

6. CONCLUSION

Community participation should include participation from the private sector. This is the so called new spirit, new dimension and a new approach for a more effective and speedy development of our country. A very important feature for the implementation of these two concepts in the field is the need to make decisions quickly and unequivocally.

After more than 10 years of experience in the implementation of these two concepts, we should make some review and evaluation of their success. I think we have mixed results - some success and some failure. Rightly to say, both these concepts are only a means to an end. The end must necessarily be an increase of national productivity on one hand and the reduction of public expenditure on the other. The ultimate result is to benefit the people and the nation as a whole.

In dengue control - the participation of the private sector include the private pest control companies. It gives the health organisation an opportunity to engage, source out their services in vector control and prevention of vector borne diseases. City Hall Kuala Lumpur started the private sector participation through the appointment of a panel of six pest control companies to carry out the spraying of adulticiding chemical. We set up a budget of RM3.5 million for this activity in 1996. In 2000, the amount of budget still remained at RM3.5 million. This amount provided enough reserves to contain more than the 6,000 dengue cases reported in 1998 and 1999. We were able to avoid the buying of new machines for thermal fogging (TF) and Ultra-Low Volume (ULV) activities. Health personnel were re-deployed. They were assigned to meet and form a better rapport with the community through health education and health promotion. Whether our decision has been done rightly or wrongly, only time will tell. The scenario so far is pleasing. We had the highest number of dengue cases in the country from 1974 until 1998; in 1999 we ranked second after Selangor and this year we ranked number seven. The process of implementing Malaysia Incorporated and privatisation is an opportunity and a challenge to both the government organisation and the private sector. Its implementation requires conviction, determination, commitment, dimension, innovative thinking and positive action to translate concepts into reality.

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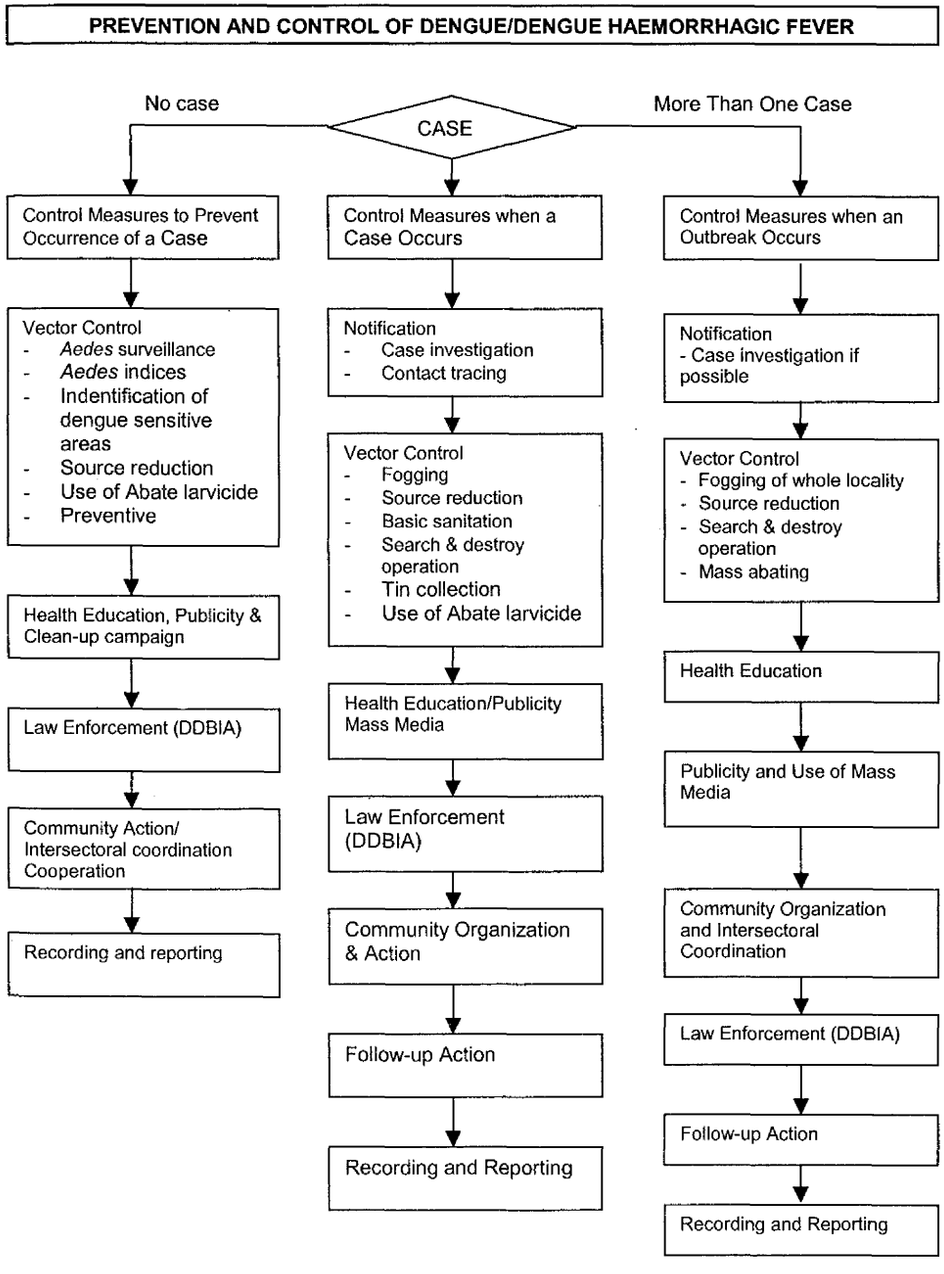
Figure 1



CONTROL OF DENGUE IN KUALA LUMPUR: UTILIZATION OF THE MLTD

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1. DENGUE SITUATION IN KUALA LUMPUR

Dengue is still a public health problem in Federal Territory of Kuala Lumpur. There is an increasing trend in the number of dengue cases notified for the years 1995 – 1998. The number of Dengue Fever/Dengue Haemorrhagic Fever (DF/DHF) cases first registered an increase in 1995 and peaked in 1998 with 7,340 cases reported. It is observed that there was an increase of about 1,000 cases annually from 1995 – 1998 (Figure 1 and 2). The water and economic crisis in 1998 seemed to contribute to the problem as many residents resorted to water storage in their houses. Another problem was abandoned projects which created many potential breeding areas for *Aedes* mosquitoes. However, in 1999 there were only 1,329 cases of DF/DHF reported when the epidemic was brought under control with a significant drop of cases by 75%. In the year 2000, this dramatic drop was maintained with only 494 cases.

Figure 1: No. of DF/DHF Notified in Federal Territory of Kuala Lumpur, 1990 – May 2000

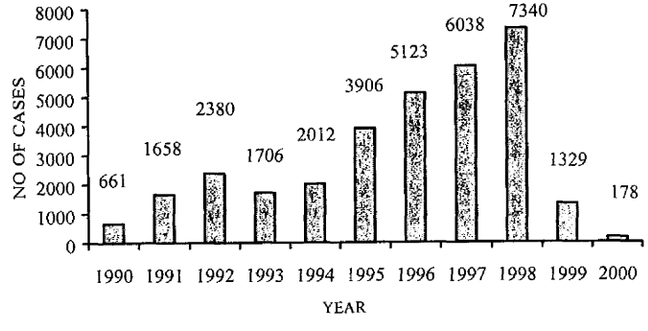
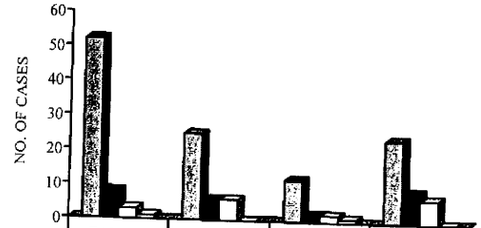


Figure 2: No. of DF/DHF Notified (Using MLTD) 1997 – 2000



	TAMAN JAYA	KG. SALAK SELATAN	JALAN PEEL	TAMAN DATO SENU
1997	52	25	12	24
1998	8	6	2	9
1999	3	6	2	7
2000	1	0	1	0

2. *AEDES* CONTROL PROGRAMME 1997 - 2000

Goal

To reduce the morbidity and mortality of dengue so that it will no longer be a public health problem in Wilayah Persekutuan.

Strategies

- Use of Mosquito Larvae Trapping Device (MLTD) to decrease mosquito population in residential areas.
- Formation of special anti-dengue epidemic control teams in outbreak areas.
- Mobilising the community to participate in *Aedes* control activities.

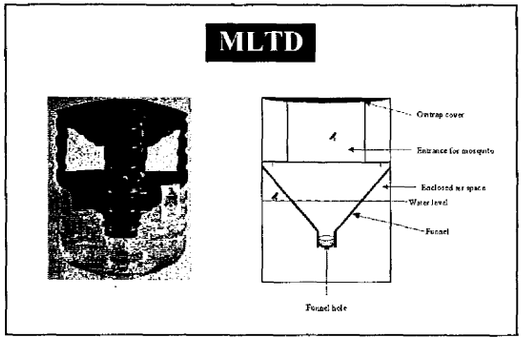
Control of dengue in Federal Territory falls within the responsibility of the Vector and Pest Division, in the Health Department of the Kuala Lumpur City Hall. *Aedes* control activities include source reduction, chemical control (thermal fogging and ULV operations), law enforcement of the Destruction of Disease Bearing Insects Act, on-going health education activities and community participation. On the preventive aspect, routine *Aedes* surveillance programmes and mosquito catches from sentinel mosquito huts are being done.

2.1 Mosquito Larvae Trapping Device (MLTD)

The cost of *Aedes* surveillance and control increased tremendously from RM2 million in 1996 to RM6 million in 1998. For the year 2000 a budget of RM10 million was allocated for vector control. In May 1997 the Kuala Lumpur City Hall initiated the use of an ovitrap called **'Mosquito Larvae Trapping Device'** (MLTD), a device

designed by its own officials (Diagram 1). The objective of using MLTDs is the gradual reduction of the mosquito population by trapping the larvae and adult mosquitoes.

Diagram 1



In August 1997, the MLTD pilot project was started at Salak South New Village. Health personnel trained about 200 volunteers on the use and care of MLTD. Readings of the number of larvae and adult mosquitoes trapped were monitored weekly. The number of DF/DHF cases reported is as shown in Chart 3. The project was expanded to other residential areas like Taman Jaya and in outbreak areas like Desa Tun Hussein Onn and Kampung Baru. Before the 1996, the Institute for Medical Research (IMR) had collaborated by including the use of MLTD as part of its behavioural research on dengue transmission and control in three areas, namely, Taman Tun Dr Ismail, Wangsa Maju Section 5 and Kampung Haji Abdullah Hukum. City Hall provided personnel and MLTDs to support the study in 1997. By the year 2000, usage of MLTDs expanded to other states like Selangor, Perak, Johore, Pahang, as well as in some Third World Countries such as Sudan, Cuba and India.

2.2 Formation of Special Anti-dengue Epidemic Control Team, 1998

In 1998 when the number of DF/DHF cases reached a peak of 7,340 cases, five Special Anti-Dengue Epidemic Control teams were formed. Their main task was to implement comprehensive vector control in outbreak areas and mobilise the community to participate in *Aedes* control using the MLTDs. The outbreak areas included Desa Tun Hussein Onn, Desa Pandan, Vista Angkasa and Kampung Baru. Members of the community were informed about the objectives of the teams with the emphasis that ownership of vector control activities lies with the communities concerned. The communities accepted the use of MLTDs in their premises and allowed inspection of their houses. Chemicals were also supplied to facilitate abating especially for breeding vessels like cement/concrete bathtubs. On-going health education activities were integrated with kindergartens, schools, mosques and shopping complexes to promote awareness of prevention and control of *Aedes* mosquitoes.

3. OTHER ACTIVITIES UNDER VECTOR CONTROL

3.1 *Aedes* Campaigns

Aedes campaigns are conducted three times a week. Activities are centralized and targeted at specific premises like construction sites, factories, schools and residential areas which have few dengue cases but high *Aedes* density. Activities such as source reduction are regularly carried out including the effective implementation of the Destruction of Disease Bearing Insects Act, 1975.

3.2 Special Squads

This team consists of a Senior Public Health Assisstant and 10 Public Health Assisstants who are stationed at the Secretariat Central Function. They are responsible for activities such as source reduction at premises like the palace, embassies and tourist attraction spots like the National Museum, Bird Park, Merdeka Square and hotels.

3.3 Privatisation of ULV Spraying, 1997

Since 1997 ULV spraying has been contracted out to seven private pest control companies. Their work is strictly monitored by Public Health Assisstants and Health Inspectors.

3.4 Use of Polystyrene Beads, 1999

Polystyrene beads were used in septic tanks in Miri, Sarawak for control of dengue and proved to be successful in reducing dengue cases. In Kuala Lumpur, this technique has been experimented to fill the chambers of septic tanks in schools. These areas were inspected every three to four months for any technical problem or replacement. If successful, this project will be extended to residential areas with septic tanks by the year 2000. A budget of RM10,000 has been approved for this project.

4. DISCUSSION AND CONCLUSION

Dengue/Dengue Haemorrhagic fever is still a global public health problem. It is widespread in the tropical areas of the world. Community participation plays a major role in the prevention and control of the dengue problem. This will require community ownership of the dengue problem and control programmes. The use of MLTDs is an example of such activities.

The ovitrap was first used for surveillance of *Aedes aegypti* in the United States (Fay and Perry, 1965). The ovitrap was subsequently used for detecting *Aedes aegypti* in low-density areas in *Aedes aegypti* eradication programmes in the United States

(Jakob and Bevier, 1969). The modified version of the American ovitrap was effectively used for control of the *Aedes* vector in Singapore Paya Lebar International Airport (Chan, 1973). The ovitrap has been used successfully in the eradication of *Aedes aegypti* from the Singapore airport.

In the Federal Territory of Kuala Lumpur, the use of MLTDs showed reduction in the *Aedes* population when it was used in Taman Jaya, Bandar Tun Razak, Cheras (Zainol and Sulaiman *et al.*, 1998). The MLTD is a practical and simple tool to use. It is also economical, both in terms of labour and time as compared to larval surveys. It is acceptable by the public and helped to improve community cooperation in dengue control. It is positive to note the change in behaviour of the public, e.g., in asking for MLTD replacements instead of fogging. Through the use of MLTDs the communities are now aware that chemical control is not the only solution to mosquito problem.

Abating is a simple procedure but difficult to sustain unless a continuous and free supply of Abate is available. This means that the product should be easily available in the community.

It is observed that law enforcement is the lowest priority in outbreak areas and residential areas. Community participation needs more environmental-friendly techniques and good relationship between the community health authorities. Using the MLTDs the community is willing to allow house inspection as they would not be prosecuted if breeding sites are found at their premises. It is also important for the community to routinely participate in source reduction activities in their homes and surrounding areas to eliminate breeding sites.

Since 1997, there has been a paradigm shift in vector control strategies in Kuala Lumpur towards more community and environmental friendly approaches. Community participation is improved with the use of MLTDs and minimum enforcement of legislation. Rapport is closer with the community through the efforts of our Special Anti-dengue Epidemic Control Teams. Participation from private sector, commercial agencies and non-governmental organizations has also helped to reduce the risk and burden of disease.

For future plans, a biological approach in vector control has been added in the strategy for the year 2002. The project for rearing guppy fish to control the breeding of mosquito larvae has been approved. This project is also environmental-friendly. The number of dengue cases has reduced drastically since the months of November–December 1998 till the year 2000. This success needs to be reinforced with new ideas and support from the community for a sustainable and attainable control of dengue.

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PARTICIPATORY ACTION RESEARCH (PAR) IN DENGUE/ DHF CONTROL

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1. INTRODUCTION

Participatory action research (PAR) has rooted in the social sciences research since other approaches failed to fulfill the gap between science and reality (Whyte, 1991). It is a process that combines education, research, and collective action in the case study research. It involves working with expertise and community organizers to help solve practical issues (Deshler and Ewent, 1995).

This approach in research is not a methodology rather it is a perspective in framing social science research to fulfill the gap between the researcher and participants. It is not an exclusive idea for certain types of research but it works as a base for making research more useful to the immediate people or group being studied (Guerrero, 1995).

PAR is a framework within the social science research that provides the space in research procedure to build community involvement. In addition, it fosters or acknowledges local resources to achieve research goals. It is common for researchers in their hypotheses to manipulate their research. This gives us the assumption that participants are passive groups or subjects who fulfilled the demand required by researchers. However with the introduction of PAR or action research by Kurt Lewin in 1947 a new paradigm of relationship between social science research and social action is built (Wadsworth, 1998). PAR can include either quantitative or qualitative methods. It offers researchers and participants options to achieve the research objectives. PAR is well known as an approach developing from collective works among different fields to bring about desired changes in groups or communities.

Literature on social science research agrees that PAR is a perspective in research that introduces the importance of collective process in deciding the implications and conclusions among those who are in the first place led the research to take action (Wadsworth, 1998). It is all about bringing the elements of empowerment, reversing inequalities and power transformation among individuals and organizations involved (Huizer, 1997).

PAR is defined by literature as a research process that entails the use of all available and/or relevant parties actively in order to bring about change or improve a selected situation. It comprises an understanding of the unique contexts of the scene, critically examining and reflecting the grass root problems. PAR or action research actually is a case study in nature where only one case is being researched at a time. It focuses on the immediate problem and at the end suggests actions to be taken as the

consequences. Robson (1993) perceived this kind of research as a reciprocal action between the researcher and participants in the particular context and case study. He added that in PAR it is a must to call for direct involvement from practitioners and/or participants in every step taken during designing, implementing and the use of the research to change the situation. The steps are a cycle that consume time and require mutual actions among parties involved in the study.

In social science research there are methods and methodologies available that can be altered into PAR. PAR introduces important steps to obtain goals intended for the research. Wadsworth (1998:4), listed a few distinctions that differentiate PAR with previous social science research:

- Adding more consciousness and detail in building problem statements by asking more questions on why there is a problem and who see it/them as problems.
- Purposely plan the process of inquiry and who to involve in the data collection.
- Setting up data systems to design, implement and evaluate from beginning till end, besides reserving enough time to document and record participants' thinking and reactions.
- Becoming more comprehensive and skeptical in checking hunches and taking more time to come up with conclusion at all stages.
- Being specific and selective in using useful and powerful theories to improve knowledge and practice within the chosen context.
- As a cycle, changing actions and reactions become the critical parts and this works as a basis for further research.

This paradigm gives research more validity in their conclusion within a given context after being tested. Furthermore in PAR, researchers and participants have all the means to gather data or produce actions according to the need.

As mention earlier, PAR offers circular processes that have to be followed in order to achieve a desirable result. This cycle involves 3 general steps:

- Planning exploration;
- Action taking;
- Evaluating the results (factual data).

The basic spiral has been developed according to the development of social science research but with a few changes to fulfill contemporary goals of research agenda. Presently, research in third world countries or developing countries works as an agent or tool to initiate social change or to benefit participants in some way (Gonzales III, 1998). The new paradigm of PAR is now intertwined with other beneficial actions in

the society such as community participation and behaviour modification to eliminate certain practices or to produce desirable results. PAR produces research that is not only documented, recorded and read but also yield tangible results when applied to real life. Isolation of research from society can be seen as a waste if the results cannot improve life conditions. PAR is now a useful tool to promote health and community development in developing countries.

The question of validity or reliability will depend on the researchers and methods or methodologies used to achieve the results. Time, money and energy are the important elements in PAR perspectives because these elements can hinder significant results.

2. USING PAR IN PROMOTING BEHAVIOURAL CHANGES IN DENGUE CONTROL [1]

Nobody can claim that they discovered the best way to do applied social research. Changes in human beings can only be measured if they are in action and we can only achieve that by thorough observation. Basic questions on whether the participant's actions are influenced by our existence or by their natural behaviour is still valid. Developmentalists and health promoters have to face another fundamental task to ensure that changes in behaviour will last. Since the 1970s, social scientists have come up with a new shift in behaviour modification and this is a step to increase community participation.

Using PAR and activating community participation to control dengue fever is not an alien approach. It is becoming a part of health promotion besides other common mediums such using campaigns, talks, clinical support and audio-visual aids in media worldwide especially in South America, Africa and other ASEAN countries. In Sarawak particular, the PAR approach is still a new perspective in promoting behaviour changes in dengue prevention in two villages that have high *Aedes* index. The two villages are "time bombs" awaiting an outbreak of the virus. Nevertheless, PAR is not new to the staff at Kuching Health Department in Sarawak because they have been involved in other health promotions using PAR and community participation in rural settings. However, most of the health personnel still consider this as a new approach or framework to achieve behaviour change collectively.

Based on this project, PAR and community participation has been combined to produce tangible results that give health promoters options to deliver control or preventation programmes in rural settings. PAR is implemented mostly in the preparatory and intervention stages. This project follows the principles of simple communication, good timing and community involvement. The project initiates interdisciplinary team members to work together and design the best approach to deliver projects.

[1] Presentation is based on the project that employs PAR to promote behaviour change in preventing and controlling dengue.

The project team comprise of staff from the State Health Department and Social Science faculty of Universiti Malaysia Sarawak (UNIMAS). The project went through 3 stages within 2 years: the preparatory phase, intervention phase and post-intervention phase. The project is planned not only to eliminate the risk of dengue fever (preventing breeding sites) but also to promote healthy lifestyles among target groups. PAR in this project is delivered by trying to understand the focus groups. The findings are used as a guideline for taking action to prevent dengue epidemic. Details of this research is presented in Kamaliah Mohamad Noh's paper on "PAR in Dengue Control: Case study of two rural communities in Sarawak" found in Part II of this Workshop Proceedings:

2.1 Preparatory Phase

As PAR is developed to acknowledge participants' opinion and needs, the first step in the preparatory stage is to get as much information as possible on the focus villages. This stage comprises two important activities: doing research using multiple research methods and training of facilitators for the intervention phase. This phase requires many researchers and consumes a long time to collect the desirable data concerning the villagers. In doing this, data are gathered from knowledge, attitude and practices (KAP) study, community study (overall situation of village and its occupants), focus group discussions (level of villagers' knowledge on *Aedes* and dengue) and entomology survey on *Aedes* index in the villages.

Basically, team members from different disciplines apply their own knowledge and skills to get an overall understanding of the situation faced by the villagers. Entomology surveys and KAP studies are used to evaluate the effectiveness of the programme after the intervention stage. It is very important to understand the real situation within the context together with supporting opinions and views from the community regarding their needs. This is also considered as what the community sees as a necessary intervention to achieve the project goals.

Based on the data gathered during this stage, an intervention framework is planned. In this project, workshops for both villages are conducted at accessible places. The community has to spend 5 days (full time) in the workshop. All these elements should be considered earlier by using the information from the research such as selection of the dates, participants and materials for the workshop.

Facilitators are then trained to work on the workshop materials according to the community background. Facilitators will test and evaluate all the materials according to the project goals, focus groups' background and suitability. Having the available data from all aspects provides enough information for researchers to start the action and intervention phase.

The success of the next phase relies heavily on this stage. The selection of the right methods and methodologies are necessary to abstract right information from the right resources.

2.2 Intervention Phase

Sharing knowledge and empowering principle are critical to increase community participation projects. These will enable the authority to learn, understand, test and implement whatever measures in dengue control and prevention that are suited to their way of life. The feasibility of control or preventative measures achievement is not in the hands of researchers but the community who will have to confront the consequences of any kind of diseases or epidemics. Enforcing alien beliefs will only contribute more to resistance rather than acceptance.

The villagers choose their own representatives to participate in the workshop. The preparatory research findings showed that participants are chosen by villagers among the village's committee members. The only influence that we have is the possibility of asking them to select participation according to 1:1 male to female ratio. Workshop facilitators or researchers and practitioners face many challenges in trying to transmit knowledge and skills to the participants. During this process, community empowerment agenda is practiced indirectly without having to put them on paper. Facilitators plan the workshop in a way that the workshop timetable allows certain time for assessment to take place despite any unpredictable problems that might occur. To achieve meaningful results, it was discovered that field workshops cannot ignore nature and human factors.

The workshop tries as much to equip participants with knowledge about dengue (identification of dengue as a problem, understanding about the concepts of cause and effect of the mosquito problems). The workshop ended with short-term or long-term action plans proposed by participants for their own community. The workshops were very hectic and required commitment directly or indirectly from every individual involved. The workshops stressed the idea of educating and informing the nature of the symptoms and transmission of the disease using the local (community) "language".

Continuous evaluation process is adapted in this intervention by facilitators and participants. It gives an overall scenario on the performance of facilitators, the effectiveness of the materials and the way the workshop is conducted.

Choosing the level of intervention and projecting the time frame for the effect to take place is critical in preventative and control measures especially in less developed or developing countries. Advances in alternative preventative intervention, especially when targeting the community is more valuable within a given budget. Even with the advancement of chemical and media intervention the effectiveness is yet to be achieved satisfactorily. In contrast, the cost increases with needs because the intervention programme is not only aimed at the urban but also the rural areas.

2.3 Post-intervention Phase

Every project will go through the termination stage. This stage gives space for monitoring and immediate evaluation on the effectiveness of intervention activities. Questions of how, who, what, when and where should be answered first in the preparatory stage before the intervention phase begins. It is crucial to make comparisons between behaviour before and after the intervention takes place. The post-intervention relies on team members' evaluation using two indicators: the entomology and social survey or KAP. *Aedes* index, KAP study and direct observation by team members are the earliest indicators to monitor the direct impact of the intervention. Both measures are used to see the change in overall behaviour within the community. However the evaluation rests on the hands of the research team and not on the community. Time and resources are also limited to the team members if they want to share the evaluation with community members.

The last stage of this project is called post-intervention. It is easy to claim achievement of this project if the researcher only judge the change of behaviour shortly after the project ended.

Valid and reliable evaluation measures are needed to give enough information to expand the project or start new ones. This is a stage where any mistake, weakness and limitations are transparent and waiting to be uncovered.

PAR reverses the conclusions from final findings to starting points for better research and practice in all case studies. Learning from on-hand experiences and practice gives more input for better results in future for health promoters and practitioners.

3. CONCLUSION

There is no procedure that can solve all the problems in health promotion programmes. The best approach in research or study that give tangible results may be suitable for one case but not the other. However PAR approach has provided the basic framework in dengue control or prevention that combines reciprocal action and reaction among all parties involved. Literature on development and health intervention in the community level agrees that PAR requires collective work among multidisciplinary participants in a project using available and possible methods and/or methodologies to produce useful results.

Preventing and controlling dengue is not economical on a limited budget with the increasing cost of health promotion and insecticides in developing countries. All other possible approaches that minimise cost are valuable not only to the government but also to the community that has to face the consequences of dengue epidemics. The economic and social consequences are beyond one's imagination if preventive and control measures fail to overcome this problem.

The visible distinction between PAR and other approaches in controlling and preventing dengue hemorrhagic fever (DHF) and dengue shock syndrome (DSS) is the space provided for targeting community participation in the research. Learning from this project one can agree that community background and situation are important elements before any action can take place. PAR insists that researchers, professionals and practitioners empower communities to manoeuvre projects according to the community's capabilities and resources (Mikkelsen, 1995). In other words, it is a bottom-up approach where the community after receiving information on dengue, decides the best way to prevent and control dengue outbreak in their villages.

Effective participatory approach requires commitment and genuine values among researchers and practitioners even though there are advanced technologies available for fighting community health problems. (Spector, 991). The question of sustainability and cost-effectiveness should be included in dengue and DHF control and research as time and energy is limited in the Malaysian situation.

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PROMOTING BEHAVIOUR CHANGE IN DENGUE PREVENTION AND CONTROL

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1. INTRODUCTION

Dengue fever and its more severe forms, dengue hemorrhagic fever and dengue shock syndrome are leading causes of morbidity and mortality in Malaysia and other tropical and subtropical countries. The *Aedes aegypti* mosquito, the primary vector for dengue has flourished in these zones because of rapid and unplanned urbanization without basic amenities, increased use and indiscriminate dumping of artificial containers, and low levels of knowledge of dengue. Given that there is no vaccine available or chemoprophylaxis to prevent dengue, preventive measures currently depends on controlling the mosquito vector. Space sprays with insecticides to kill adult mosquitoes have been found to be ineffective.[1] The most effective way to control the mosquitoes is larval source reduction, that is, eliminating or cleaning water-holding containers that serve as the larval habitats for *Aedes aegypti* in the domestic environment.

This paper reviews the current status of community-based control programmes on dengue with particular reference to countries in South East Asia. The last section discusses the application of health education/promotion and behaviour change models to promote behaviour change among the community with regard to the control of *Aedes* breeding sites.

2. REVIEW OF DENGUE CONTROL PROGRAMMES

2.1 Organisation of Dengue Control Programmes

It has not been clear what the most effective approach is to control *Aedes aegypti*. Research is still going on and much remains to be learned about control strategies, particularly in urban areas. In the traditional centrally planned, vertically organized dengue control programmes, the government has accepted the responsibility for mosquito control and communities were dependent on those services. However, these traditional programmes have recently been less effective due to the high costs of labour and insecticides. Many countries faced constraints in manpower and material resources which made it difficult to carry out spraying activities, check houses and other premises and enforce legislation pertaining to vector control.[2] In addition, most of the larval production sites are found on individual property lots, vacant land and most dengue transmission takes place in the home environment.

In view of the above reasons, many countries have now advocated horizontal programmes in which both decision-making and distribution of personnel are decentralized, increased emphasis is placed on health education, and communities are actively involved in eliminating the breeding sites and controlling mosquito breeding.

2.2 Community-based Programmes on Dengue Prevention and Control

Community-based programmes which incorporated health education to increase the awareness of dengue, and community participation to control larval breeding sites have shown mixed impact.

The *Aedes* control programme in Puerto Rico, that was funded by Rotary International and the local health department, enlisted boy scouts to carry out public health education and elimination of *Aedes* breeding sites. A decrease in larval indices was found in areas where the programme was in full swing.[3] A community-based project in Thailand that mobilised schools, volunteer organisations and local government in source reduction led to 84% reduction of Breteau index after one year.[4] In Taiwan, the government-initiated community-based *Aedes* control programme, which involved the schools, women's club, army service clubs and farmers' associations in eliminating the *Aedes* breeding sites, reported a reduction of the *Aedes* house index from 44% in 1988 to 9% in 1991.[5]

One of the better study designs to evaluate the effectiveness of a community-based intervention *Aedes aegypti* control programme was carried out in Mexico in 1989.[6] An untreated control group design with pre-test and two post-tests was used to assess change in knowledge and behaviour and Breteau index. The four-month community-based communication programme aimed at larval production site elimination included community wide meetings, home visits and organization of community workgroups for the design of appropriate materials. The health message placed the top larval production sites into broad categories with similar items and control strategies, and addressed common misconceptions of mosquito breeding sites. The intervention emphasised activities that would be relatively easy to perform and did not require additional expenses. These activities included turning the containers over after use or making holes in disposable containers. Each pamphlet was specific for the audience to which the information was directed; therefore one message was designed specifically for men, one for women and the third for the general audience. To ensure the relevance of the message to local residents, photonovels (short story in comic books) were used with photographs of residents in the intervention communities acting out the story line. The intervention led to significant changes in knowledge and behaviour in the intervention communities. The Breteau Index showed no increase in the intervention communities compared to a significant increase in the control areas.
In some countries,[3] the community-based dengue control projects were limited in their effectiveness probably because of the following reasons:

- The projects have focused on disseminating information and not changing behaviour.

  These projects adopted the traditional approach by focusing on disseminating information about dengue and its prevention because it was assumed that knowledge by itself would be sufficient to bring about behaviour change. Recent research has shown that a knowledge-behaviour gap exists, with knowledge not always translating into action. Behaviour change is very complex as it is influenced by factors other than knowledge; these factors include cultural beliefs, personal experience, skills, barriers to change and the physical and social environment. As an example, some homeowners may not take steps to control larval breeding as their personal experience with dengue lead them to conclude that, although dengue can cause great discomfort for a few days, it is in no way a life-threatening condition. Giving another example, not all residents who know about the larvicidal properties of Abate will use it if they cannot have easy access to Abate or if they do not find it acceptable to put Abate in drinking water.

  A study in Singapore also showed that knowledge is not readily translated into action. Although about three quarters (77%) of respondents cited stagnant water in receptacles as breeding places, less than half (49%) actually removed such receptacles and an even lower percent (26.7%) changed water in vases frequently or applied chemicals.[7] This knowledge-practice gap could be explained by the inconvenience, lack of time, incompatibility with daily routine, and the perception that no immediate, visible, tangible benefit could arise from such preventive measures.

  Health may not be a high priority as many poor people are faced with a range of other more immediate problems. Employment, income, food and access to a water supply are commonly thought to be more important than health concerns, especially in contrast to hard-to-recognize dengue.

- Restriction of community participation to labour-intensive and non-technical activities.

  The restriction of community participation to labour-intensive and non-technical activities such as community clean-up campaigns has greatly reduced the viability of participatory strategies due to the following reasons. First, these activities are perceived by people as low-cost and poor quality substitutes for services such as spraying with insecticides. Second, non-technical activities are generally perceived by the community to have low efficacy. In other words, if someone fills in a ditch, the community will probably not notice any immediate decrease in the local mosquito population, but if insecticide is sprayed, at least a temporary decrease in mosquitoes is noticed.

3. PROMOTING BEHAVIOUR CHANGE

Intervention programmes to reduce risk behaviours associated with *Aedes* breeding must be based on (i) an understanding of the multitude of individual and environmental factors influencing behaviours (ii) identification of the important target groups for targeting behavioural change (iii) and the application of theories from social, anthropological, communication, behavioural and psychological sciences to change behaviours associated with the proliferation of breeding sites of the mosquitoes.

3.1 Behaviours Leading to Increase in Larval Breeding Sites

The *Aedes aegypti* mosquitoes breed mostly in domestic man-made storage containers. The proliferation of larval breeding sites is very much linked to human behaviour which include:

- Indiscriminate disposal of unwanted or used containers by homeowners and workers at construction sites. These containers include non-biodegradable plastic containers used for domestic consumer goods, automobile tires, artificial water holding receptacles.

- Storing water without covers in containers for drinking, bathing and washing.

- Non-use of larvicidal chemicals, e.g., temephos in 1% sand granule formulation (Abate) in storage tanks.

3.2 Factors Leading to the Risk Behaviours

The indiscriminate dumping of containers is partly due to environmental factors such as the lack of or improper rubbish disposal facilities. Containers in Malaysia have also been indiscriminately dumped by residents, contractors or garbage collectors, at abandoned housing projects or vacant land some of which were private property. These areas found adjacent to the housing units were overgrown with shrubs and dumping of containers at the edges of the land were commonly seen.[8] Other sources of breeding in Malaysia were found in poorly maintained septic tanks in houses, blocked roof gutters and flower vases used in cemeteries.[9] In Singapore construction sites have also been identified as a major source of larval breeding in many outbreaks.[10]

The increased use of water storage containers for drinking, bathing and washing has been aggravated by shortage of water or inadequate water supply. In Thailand, for example, between April to June 1989, the average number of receptacles per house increased from 5.8 to 7.9 when there was severe inadequacy of water supply.[11] The primary sources of larval habitats were found to be water storage containers used for drinking, washing, bathing and ant-traps. In schools, flower vases and water containers in the toilet for flushing were the main larval breeding sites.

3.3 How to Apply Theoretical Frameworks to Change Behaviour

Many models have been used to explain health related behaviour; the common ones included the health belief model[12] and GREEN's framework. [13]

Health belief model: The health belief model[12] states that a person's likelihood of adopting the recommended health behaviour is influenced by his perceptions about the disease with respect to his own susceptibility and the seriousness of the disease; perceived benefits, perceived barriers, cues to action and self-efficacy (confidence in one's ability to take action). Using this model to explain how it influences his behaviour to reduce larval breeding sites, he is more likely to get rid of a breeding site if he perceives that he or his children are vulnerable to dengue and that dengue is serious enough to cause death especially in children; if he sees the benefits of reducing breeding places and that the benefits far outweigh the inconvenience, effort and time taken, for example, to change water in vases to prevent *Aedes* breeding; if the actions are easy to perform; and if he has the self-confidence to carry out the specific recommended steps (self-efficacy).

Green's framework: Green's framework[13] categorised factors influencing behaviour change into 3 main groups (i) predisposing factors such as knowledge, attitudes, beliefs and values (ii) enabling factors such as skills and resources like health facilities and (iii) reinforcing factors such as reminders, incentives, support of family members and health staff, that would lead to maintenance of the recommended behaviour or punishments that would lead to extinction of the risk behaviours.

Based on Green's framework, there are three main strategies to promote behaviour change, namely, motivate, enable and support the individual or community.

- Motivating Behaviour Change

  We can motivate the community to eliminate breeding places by telling them about the immediate and visible benefits of their actions. One problem encountered in giving health education on dengue prevention is that people may not be motivated into action, as they could not see with immediate effect whether dengue has been prevented. Thus it is important to stress on the immediate visible effects of their actions pertaining to rubbish or container disposal such as the aesthetic benefits of a brighter and cleaner neighbourhood, less smell and less mosquito bites. While they could not see immediately whether their actions led to decreased dengue cases, a cleaner brighter neighbourhood, less smell and less mosquito bites would be evident with immediate effect.

  Another strategy to motivate the community to control *Aedes* larval breeding is to link their larval control activities with economic rewards or to what the community values. It should be noted people may not be motivated to take action for health reasons alone. This is particularly so among poorer communities or slums where employment, food and access to a water supply are more important

than health concerns. We can learn from the experience of an effective malaria control programme in India.[14] The health officials there collaborated with community organizations on issues of concern to the community such as problems related to drinking water and electricity. They then proceeded to link vector control activities to economic rewards. In the village it was found that presence of algae reduced mosquito breeding. Since the algae could be used to make cardboard, there was a financial incentive for the villagers to grow, harvest and sell the algae.

- Enabling Behaviour Change

  Strategies to enable the community to adopt the recommended actions to control larval breeding include teaching or equipping them with the necessary skills and making the tasks easy to perform. Asking people to cover water in storage containers involves effort. A study in Thailand found that only about 32 to 43% would cover containers used for bathing and washing, probably because they found it inconvenient or that it took too much effort. However, a higher percent (78% to 97%) would cover the water for drinking, probably because they could see that the benefits (clean and safe water for drinking) outweighed the inconvenience of doing so. If burying refuse is recommended, there should be enabling factors such as large yards, tools for digging and soil should be soft enough.[10] If disposing of refuse is recommended, there should be some type of refuse disposal services available.

  To enable people to change behaviour, it is also important to reduce barriers such as cost and inconvenience to the change. In Thailand the Temephos larvicidal was made available at a low cost at 10 baht or (0.4 US $) per 100 gm package and was given free of charge to schools.[11] To reduce the inconvenience and cost to the homeowner, they were also told about other alternatives that can be used, for example, salt and detergents.

- Supporting Behaviour Change

  People also need to be reminded, given feedback and rewarded to maintain the behaviour change. Regular house inspections and disseminating the results of the A*edes* index and reporting the dengue cases to the community is one way to remind the community to take action to reduce or eliminate larval breeding. In Thailand, for example, a decrease in larval containers was observed after household visits were conducted by the health inspectors.

  As construction sites are one of the major sources of breeding in urban areas in Malaysia, contractors and senior management at worksites should also be reminded and given feedback on their pest-free housekeeping measures. A surveillance system for mosquito breeding should be institutionalised at construction sites by local health authorities. Annual events could be organised to

give incentives and publicise the top three best maintained sites and blacklist or put penalty fines on poorly maintained construction sites.

Finally, it is also important for government officials to support the community if we want them to dispose used containers properly. It is inappropriate to tell homeowners to throw away anything that is no longer useful if the government does not support this by providing reliable and adequate refuse collection. A community education programme on proper rubbish disposal may not be sufficient to generate sustainable behaviour change unless other factors such as providing reliable and adequate refuse collection facilities to the community is taken into consideration. Similarly, if we want the community to organise clean-up '*gotong-royong*' campaigns to clear the rubbish, health and local authority departments must support them by providing manpower, equipment, and collection schemes to clear unwanted bulky items their homes and gardens. At the same time, local authorities should also clear mosquitoes breeding in drains, open areas and construction sites because it shows the credibility and sincerity of the government in wanting to work in partnership with the community and reduces the community's perceptions that the government is passing the responsibility solely to them. In the study in Mexico,[15] informants mentioned repeatedly that there was no point in turning over buckets or disposing used containers if nothing were done about mosquitoes in dirty drains and ditches where the *Culex quinquefasciatus* breeds. In communities without water supply, the government should also address this concern and plan for provision of water supply.

All these changes are not easy as it is dependent on the socio-economic situation and it requires political commitment and decision making at higher level. Thus, it is also important to develop education programmes for local authorities and Ministry of Health officials about community perceptions and locality specific conditions. The education programmes would need to address training in behavioural, communication and community development approaches.

4. HOW TO DEVELOP COMMUNICATION PROGRAMMES TO PROMOTE BEHAVIOUR CHANGE

4.1 How to Design Messages

Once it is decided what behaviours to target, the recommendations has to be put in a form that is appropriate for specific target groups. This requires an understanding of the components of the communication processes and skills to select and combine appropriate health education media and materials that are tailored to the target groups' characteristics and meet the objectives of the message

The objective of the communication programme is to help the community understand the seriousness of dengue, their vulnerability to it and to teach them skills and specific steps on how to prevent, check for and destroy larval breeding sites.

- The communication programme must be developed with the community input and take into account local perceptions and local conditions to ensure that the information is relevant and appropriate.

- Messages have to be specific for the different target groups. For example, different messages should be designed for head of household, father, mother, maid or housing developers. In a study in Mexico[15] when women were asked about the indiscriminate disposal of tyres many women remarked that the tyres were not theirs, so they could not dispose of them or put holes in them to prevent the accumulation of water. In this case, the appropriate target group for disposal of tyres should be men. Similarly in Singapore, messages have been designed for maids as they take care of housekeeping.

- The message must have emotional appeal. For example, the use of a child with dengue was able to motivate mothers to take action to reduce or prevent larval breeding.[16]

- The message must be specific and clear. For example, the message 'get rid of or throw away anything that is no longer useful' may be misunderstood as 'dump your refuse in a vacant lot'. In this case, if there is inadequate or reliable refuse collection, the dumping of trash in a vacant lot will not reduce the overall larval indices in a neighbourhood.

  It is also important to be very specific about the common breeding sites for a particular locality and the types of containers used so that specific behavioural strategies for their disposal could be explained and communicated to the community. In Mexico, for example, cans have been classified into disposable and controllable cans for the purpose of the health campaign. Controllable cans refer to cans used in the household that can hold water. The specific message for this type of cans was to empty or turnover the can after use to prevent the accumulation of water in it between uses. On the other hand, disposal cans refer to those cans that were no longer useful and would be thrown away. In this case, the recommended advice was to make holes in them or place the container in a bag and to tie it shut. The bag should be stored under the eaves of the house until it was possible to dispose of it. On the same note, it is not good enough to tell people to change water in the fish tank. They must also be told specifically to scrub the sides of the tank to remove mosquito eggs.

- It is important to identify local residents' perceptions of each container type as a source of mosquitoes. The study in Mexico[15] showed that very few residents considered vases or animal water dishes as potential larval breeding sites. Animal water dishes were not considered by homeowners to be a mosquito production site because many thought that animals, especially chickens and ducks, would eat any larvae that happened to be there. On the other hand, some people viewed plants as a source of mosquitoes and thought that mosquito control measures should focus on cutting back the vegetation. This could be derived from their observation that

adult mosquitoes could be seen emerging from plants, which they used as a resting place. The message thus focused on telling them while adult mosquitoes may rest in the bushes, they can only reproduce in receptacles containing water such as flower vases, or water containers in the house. This message would thus affirm the validity of their observation about the adult mosquito but at the same time it drew their attention to what important larval habitats are.

- The communication programme must identify and address the common misconceptions, e.g., many cannot distinguish between *Culex quinuefasciatus* and *Aedes aegypti*. It has been found in Malaysia, Singapore and even in Mexico that many people thought that the most important source of mosquitoes is the dirty water found in puddles and drains. The health staff must explain why clean water inside vases in their homes warrants their attention too.

- The message must be interesting. Most health education messages are perceived to be very factual and boring. It can be made more interesting if the message is told in the form of a story. In Mexico,[15] for example, photographs of residents acting in the roles of the story were used in the photonovel as a means for stimulating interest and participation in dengue prevention and control, and more fully address some of their common beliefs relating to dengue and its transmission.

4.2 How to Deliver the Message: What Media and Channel?

Many different types of media and channels of communication can be used to deliver the message. The skill of the health educator is to choose or combine the most appropriate media or health education methods. The choice of media is dependent on the characteristics of the target group such as their literacy level and their media preferences and the objectives of the message. It is important to be aware of the limitations of strengths and weaknesses of the different types of media. While mass media such as radio or TV can disseminate information to a large audience quickly, it has its limitations in that it does not allow the community to express their concerns to the authorities. The use of soap operas as a health education method to motivate mothers to control *Aedes* breeding in their homes should be explored as soap operas have been found to be effective in getting mothers to use oral rehydration salts to prevent dehydration in their children in Egypt.

Phone lines may allow people to convey individual concerns about mosquito and sanitation problems, yet these may not be representative of the views of the community as a whole. Newsletters were found to be an inappropriate channel for transmitting information about dengue prevention and mosquito control. In a recent study in Brazil,[17] community newsletters were established in a pilot project on community-based *Aedes aegypti* control. The community newsletters were created to serve as a forum for the exchange for information of relevance to the neighbourhoods such as announcements of upcoming meetings or social events. The secondary objective was to use the newsletters to provide a channel for feedback and discussion

of ongoing dengue prevention activities. A survey was carried out on 44 people who have received the newsletter; only 10 (22.7%) of them had noticed and read information about refuse disposal and recycling, 9 (20.5%) about mosquitoes and 5 (11.4%) about dengue. However, a much higher proportion (68%) have read about the residents' associations and advertisements. The authors thus concluded that the newsletters were not an appropriate way to disseminate information about dengue. However, newsletters were an excellent way of mobilizing communities and promoting communication between the communication members and project personnel. Project staff participating in meetings to plan the newsletters were able to learn what the concerns of the residents were in an informal way.

5. COMMUNITY PARTICIPATION IN *AEDES* CONTROL PROGRAMMES

The objective of community participation in dengue prevention and control is to get the community to work together with health and other related government agencies in dengue prevention and control activities. As discussed earlier, this is not an easy task as the community in many countries expects the government to assume the bulk of the responsibility. This could have been due to their perception that breeding occurred in places beyond their responsibility and control such as construction sites and vacant land. Some also held the misconception that the mosquito responsible for spreading dengue breeds in the drains and this constitutes a sanitation problem, which is the responsibility of the government.

To be able to work effectively together, we need to learn how to effectively mobilise and engage the active participation of the community in vector control activities through the process of community development. Community development refers to the process by which the community groups are helped to identify problems, mobilize resources and develop strategies to solve the problems.[18]

One prerequisite for community involvement is the establishment of a 2-way channel of communication between communities and public health officials. Other important components are to start where the people are by going down to the community to listen and ask about their concerns and problems, engaging them to think critically about the root causes of their problems such as the proliferation of breeding sites that may affect their health, and empowering them to think about most appropriate strategies to solve the problems. Public health officials should support and facilitate their problem solving process, give strong support to all *Aedes* control programmes initiated by the community and work simultaneously with them to solve some of their pressing concerns such as the need for water supply and adequate refuse disposal facilities.

5.1 Planning of Community Education/Participation Programmes

Planning should be carried out in consultation with the community, and should start with a needs assessment to identify the community's pressing health or social concerns as well as to identify educational needs on dengue. For example, planners should investigate local perceptions of dengue with regard to its transmission and preventive measures, the major *Aedes* breeding sites and behaviours related to the proliferation of these breeding before planning the programmes.

There is a need for interdisciplinary and intersectoral collaboration. Every segment of the community must be involved in programme planning, including schools, religious groups the private sector such as housing developers and non-governmental organizations. With regard to the government, health and health-related professionals such as social scientists, anthropologists, health care planners, health educators and managers should be involved.

The design of community-based health education intervention should incorporate at least the following components: (i) needs assessment (ii) identifying and developing recommendations for behaviour change (iii) message design (iv) developing and producing educational materials and media (v) pretest of the message to find out if the audience understands the message, believes in it and thinks the message is related to them and (vi) monitoring and evaluation of the programme for further improvement and modification

6. CONCLUSION

The planning and implementation of dengue control requires information on human behaviour that favours the proliferation of *Aedes* breeding, the disease, the vector control measures and the environment in which transmission takes place. Whatever the underlying behavioural model, the development of an effective behavioural intervention programme should start with a needs assessment of the determinants of the behaviours that promote *Aedes* breeding and the physical, social and cultural environment in which these behaviours takes place. Qualitative and quantitative methods such as focus groups, participatory action research and surveys should be used to identify risk behaviours and the most important modifiable environmental factors associated with these behaviours. This will help in the design of more appropriate strategies to change the risk behaviours. Next, health education/promotion models/frameworks should be used to develop community intervention programmes to promote behaviour change. To be sustainable, community-based programmes must be planned in consultation with the community and should incorporate their most pressing concerns, which may not necessarily be mosquitoes or health, into the *Aedes* control activities. Time must be allotted for planning before developing and implementing the programme. Monitoring and evaluation of the programme are crucial to assess its effectiveness and to identify problems for future improvement.

With regard to programme organisation, what is required is neither a top-down or bottom-up approach alone. History has taught us that a pure top-down approach has no lasting impact after government support is withdrawn. The bottom-up approach on the other hand is very slow and may take years before results are observed. What we urgently need today are integrated and interdisciplinary behavioural strategies that utilise the best of both approaches during the initial phase, with more emphasis directed to the community-based approach as the programme progresses.

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PART II

Behavioural Interventions in Dengue Control

DENGUE CONTROL IN PENANG: INTEGRATED BEHAVIOURAL INTERVENTIONS IN CONSTRUCTION SITES

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1. INTRODUCTION

Efforts promoting behavioural change in dengue control require a variety of personal, social and cultural factors that involve a multi-sectoral approach. Although legislative and regulatory approaches are often cited as the most potent means of facilitating compliance to health recommendations, their implementation require regular and comprehensive monitoring which is costly and labour intensive. Moreover, experience has shown that regulatory approaches alone cannot ensure the widespread adoption of appropriate health recommendations. Without denying the importance of appropriate legislation and regulations, this study appeals for more emphasis on health information and education training in stemming the spread of dengue fever which has replaced malaria as the most serious mosquito-borne disease in many parts of Asia and the Pacific region (Knudsen, 1995).

The approach taken in this research is that promoting behavioural change requires the interaction of four variables. First, there must be an appropriate technology recommendation, which is developed in consultation with the users. The second involves knowledge and attitude of workers and management towards dengue control. Third is social support from management and lastly, cooperation, assistance and reinforcement from the health authorities. The key participants in this research are the workers, management and health authorities and hence the cooperation from all three parties is crucial to the successful implementation of this action-oriented research.

The overall objective of the research is to develop a health education approach to strengthen dengue control measures among workers and management of construction sites in Penang. Specifically, the research aims to (a) develop and recommend a technology package for *Aedes* larval control in construction sites; (b) identify the knowledge, attitudes and behaviour of target audience towards the cause, transmission and control of dengue fever; (c) develop and implement a health education and training package suitable for construction workers; and (d) monitor the implementation of *Aedes* control activities in the selected construction sites.

Four construction sites were selected based on several criteria. The sites selected must be still under construction with less than 50% completion when the research started. The projects should be moderate in size with the main contractor having between 30 – 100 workers. Finally, the construction firms should be willing to cooperate with the researchers in implementing the health education package. The first site selected involved the construction of 250 low-cost units and 142 units of flats, the second was a market complex, the third was the construction of 53 units of

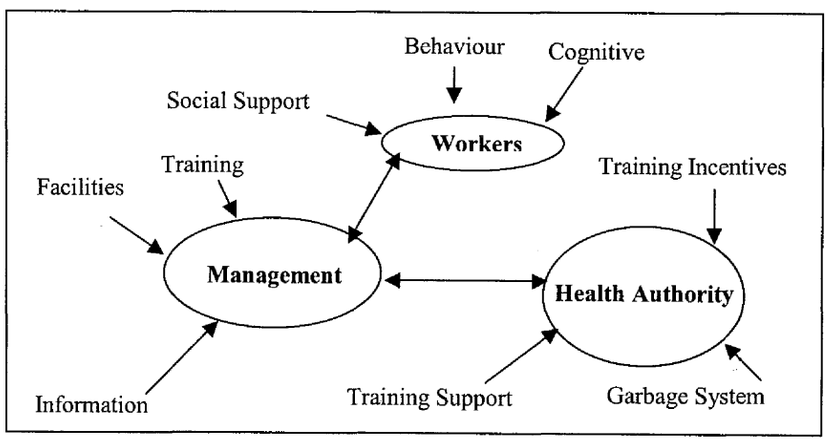
double-storey terrace houses and the fourth site comprised two blocks of medium-cost apartments.

2. CONCEPTUAL FRAMEWORK

Literature on behaviour change from the psychological perspective tend to be based on the information-processing model which suggests that health behaviour is a function of the acquisition of information, one's attitudes and past experiences (favorable or unfavorable). It is well known that information and knowledge sometimes may or may not lead to attitudinal and behavioural change. This is because apart from information, there are other important variables such as incentives and facilities that have been found to affect peoples' actions.

In this research, emphasis is given to establishing meaningful interactions between three main participants as this will result in a far greater likelihood of success than focusing only on providing health information and education training (Diagram 1). Workers' behaviour are more likely to change if interventions include positive support from management such as providing regular training, information dissemination, tools and facilities to ensure site cleanliness and support for the anti-mosquito teams. Likewise management is more likely to give positive support if the health authorities give positive reinforcements and incentives to companies that provide training and other serious efforts to reduce the incidence of mosquito larval breeding in their construction premises. Hence a three-way cooperative and supportive relationship is more likely to work than merely giving sporadic information and imposing fines.

Diagram 1: An Integrated Behavioural Model for Dengue Control



3. STUDY DESIGN

Based on the above framework, the research has been divided into three phases. The first phase is a cross-sectional study utilizing a combination of qualitative and quantitative techniques to find out the pre-intervention knowledge, attitude and behavioural levels of workers, contractors and site supervisors.

Following that is the intervention phase to improve dengue control in selected construction sites. Based on the pre-intervention knowledge, attitude and behaviour levels, a health education and technology package was developed. Training materials such as posters, handouts and video were prepared to provide the necessary information on the (a) dangers of dengue fever (b) identification of *Aedes* breeding sources and (c) individual and group control measures to prevent larval breeding. This is the first time training materials were prepared specifically for the prevention of dengue control in construction sites. Health education sessions were carried out twice in each of construction sites. The research team members together with the district health officers conducted the health education sessions in Malay, Hokkien and/or Mandarin. The overall focus of the sessions was to convince workers and management that the disease is serious, even life-threatening, but can be easily controlled by maintaining the general cleanliness of the place and proper management of all water-bearing containers.

During this phase an anti-mosquito team in each construction site was formed. Names of the anti-mosquito team were announced by the site supervisor during one of the health education sessions to allow them to publicly announce that the team was formed with management support. Each team was given a sprayer pump, the recommended chemicals (sufficient for two treatments) and incentive T-shirts. The members were taught the correct techniques and timing of chemical spraying and the appropriate places to spray.

To convince both management and workers the effectiveness of their efforts, weekly larval and breeding source surveillance of mosquitoes was carried out. The Container Index (CI) for the presence of larvae in random selection of containers was plotted. This was used as feedback to supervisors and contractors to convince them of the effect of their control efforts. The CI data showed general reduction in mosquito eggs and larvae and this provided positive reinforcements to management and workers to continue giving support to the anti-mosquito activities.

The final phase is the post-intervention evaluation of the research. This was carried out by conducting a survey of the knowledge, attitude and behaviour levels of the target audience as well as conducting informal feedback, discussions with contractors, site supervisors and the anti-mosquito teams.

4. RESULTS OF PRE-INTERVENTION STUDY ON KNOWLEDGE, ATTITUDES AND PRACTICES

Study findings showed that management's knowledge and attitudes towards dengue and mosquito control were good on the whole. The management had a high knowledge of dengue fever and was aware of the cause and transmission of the disease. Most (80%) of them were knowledgeable of the common types of vector breeding places at the construction site (such as clogged drains, empty bottles, styrofoam food containers, old tyres, building basements and empty cans). However lift shafts and balconies were seldom mentioned by most of the respondents. All contractors and site supervisors perceived that mosquito breeding could be prevented at the sites and were favorable and positive towards control of the disease.

Oiling of water surface areas with used diesel oil was the most common method used to control mosquito breeding. All study sites reported the use of this method within the last three-month period before the study intervention. This was confirmed by our observational study. Most of them preferred using used diesel oil as it was cheap and easily obtainable from heavy machinery at construction sites, easy to use, and it was one of the recommended methods by the health personnel. Treating water tanks with Abate granules, covering water containers, larviciding and '*gotong-royong*' to clear rubbish were carried out on a lesser and sporadic scale. Fogging and pumping out clogged water were rarely applied to prevent mosquito breeding at the site.

Two major factors were found to influence the presence of total number of potential breeding sites. The size of the project and the type of buildings constructed (such as terrace houses or high rise flats/apartments). In large sites that involved high rise buildings, management usually gave the reason that it was too difficult to ensure complete absence of breeding sites as small water spots could be easily overlooked. Management also claimed difficulty in carrying out control activities in the upper level of tall buildings under construction. Another important contributing factor for the spread of dengue fever was the existence of dirty '*kongsi*' houses within the site and the use of semi-completed buildings to house construction workers. Cleanliness of the environment surrounding these temporary shelters was usually neglected. Containers such as sardine cans, styrofoam food boxes, etc. were abundant and garbage was not regularly disposed in all the sites. All of the study sites did not subscribe to the rubbish disposal services provided by the local city council, purportedly due to high cost of garbage disposal imposed by the local council.

The pre-intervention study found construction workers to be very much less aware of dengue fever. Only slightly more than half (56%) had ever heard of the disease, whilst the rest were not knowledgeable of it. Among those who have heard of dengue fever, almost all knew that it was 'caused' by mosquitoes, but only half could identify that the disease was spread by the *Aedes* mosquito. Knowledge on symptoms was significantly lower. The construction workers who were interviewed were very much less informed about dengue mosquito breeding sites compared to the contractors and site supervisors. They failed to identify most of the major potential breeding sources

at the construction sites (such as balconies, lift shafts, basements, water tanks, etc.). Foreign workers were significantly less aware of dengue fever compared to the locals. Less than two-thirds (61%) of the respondents perceived that mosquito breeding could be prevented whilst the perception of the rest was negative. Workers' knowledge of types of mosquito control measures was much lower compared to that of the management. Information about the disease was mainly obtained through the television and radio. The workers had indicated a positive attitude towards mosquito control. Most mentioned that they were worried about contracting the disease and agreed that control of mosquito breeding is the responsibility of everyone. Most of them were of the opinion that cleanliness of the workers' environment is very important in preventing mosquito breeding and that mosquito control activities would not interrupt work at the construction site.

Reports of preventive practices against mosquito breeding were low among the workers. However, the adoption of personal protection against mosquito bites was significantly higher than prevention against mosquito breeding.

5. RESULTS OF POST-INTERVENTION SURVEY OF KNOWLEDGE, ATTITUDES AND PRACTICES

Out of the total of 104 workers interviewed for the post-intervention survey only 48 (or 46%) reported that they were aware of the anti-mosquito campaign and only 38 cases (36.7%) had participated in it. About a third (33.7%) of these workers mentioned that they had attended the educational session and 35 (33.6%) had attended the video session. Ten respondents were members of the anti-mosquito team. About half (42.6%) of these workers said that they had involved themselves in the '*gotong-royong*' activities. A majority (89 or 85.6%) had mentioned seeing the posters on mosquito control at the construction sites.

Feedback on the things learnt from the various types (talk, video session, and posters) of educational activities was obtained from the workers. Most of the workers reported that they had learnt about the importance of keeping the construction site clean to prevent mosquito breeding as well as various methods of preventing mosquito breeding.

Awareness of dengue fever, its cause and symptoms did not differ significantly between workers who were exposed to the health intervention and those who were not. The proportion of workers in the exposed group who have heard of dengue fever was slightly higher compared to the non-exposed groups (64% and 56%, respectively). Post- intervention findings showed the knowledge on symptoms was still low in both groups. As the health intervention did not focus on the symptoms of dengue fever, it is not surprising that knowledge level on this aspect is low among the exposed group.

The health intervention focused mainly on the identification of dengue mosquito breeding places and this seemed to have shown some results based on findings that showed significantly higher knowledge among workers who were exposed to the programme. Significantly larger percentages of workers from the exposed group were recorded for all mosquito-breeding places with the exception of water containers compared to the non-exposed group ($p<0.05$). This suggests that workers who were exposed to the health education were more likely to recognize the mosquito breeding places compared to those who did not receive any health education. Although a significantly larger proportion of those who had received health education could identify the various breeding places, it was noted that the numbers who reported on the types of breeding sources that are common in construction sites (such as water tanks, balconies, lift shafts, basement, etc.) was still low.

A significantly large percentage (90%) of workers who were exposed to the health education stated that mosquito breeding could be prevented compared to 61% of workers who did not receive any health education ($p<0.05$). This suggests that workers who were better informed about mosquito control through the health intervention were more positive about preventing mosquito breeding.

Knowledge on methods of preventing mosquito breeding did not differ between the two groups of workers. Despite the health education sessions on measures to prevent mosquito breeding, it was evident that this did not significantly improve awareness of the workers in the exposed group. This may be due to the fact that many of the exposed workers were Bangladeshis who faced language difficulty in understanding the talks given.

A larger percentage (61%) of workers in the exposed group mentioned that they had taken action to prevent larvae breeding at the construction site compared to less than half (46%) of workers in the non-exposed group that reported such activities. Four types of measures were usually adopted to prevent mosquito breeding (i.e., larviciding of water storage containers, covering water storage containers, cleaning drains and destroying unwanted water containers). These measures did not differ between the groups.

Reported action taken to prevent mosquito bites was very good for both groups of workers. More than 90% of both groups of workers had reported taking preventive measures against mosquito bites. Use of mosquito coils and fans were the most common, followed by insecticide spray.

6. SURVEILLANCE OF BREEDING SOURCES OF *AEDES* MOSQUITO LARVAE

6.1 Methods

Sampling sites were classified into two groups; high-rise and low-rise. High-rise sites comprised multiple-storey building such as flats and/or condominiums; while low-rise sites comprised buildings that are less than five storeys. Three low-rise sites were chosen in Batu Maung, Bayan Baru market complex and a housing complex in Bukit Jambul. The two high rise sites were at Batu Maung and Bukit Jambul apartments. At Batu Maung, most parts of the site face a secondary forest and hillside. Only one of the construction sites is located adjacent to a residential area. On the other hand, the study sites in Bayan Baru and Bukit Jambul were surrounded by residential areas, with little vegetation around them. Mosquito breeding sites were surveyed weekly for larvae and samples were taken from almost any conceivable water-holding containers found inside and outside the construction buildings.

Weekly survey of breeding source for *Aedes* mosquito larvae was carried out in all the selected construction sites. It was conducted from May to September 1999. Samples of larvae were taken from water-holding containers (both outside and inside buildings) such as water tanks, balconies, flooded floors, iron drums, lift wells, styrofoam lunch boxes, wheel barrows and clogged drains. The larvae were sampled by using either a standard dipper with extendable aluminum handle or a plastic pipette, depending on the amount of water, size and shape of the container. When a large amount of water was present, such as in a deep container, the larvae were sampled by gently lowering a dipper at more than one point and allowing water to flow into it. Otherwise, the larvae were sucked by the plastic pipette. The larvae were collected five times for each dipper and pipette. Finally, the larvae samples were replaced into discharged bottles and brought back to the laboratory for counting and identification. The results obtained for source reduction of mosquito breeding were expressed by the following Container Index (CI)

$$CI = (\text{containers positive} / \text{containers inspected}) \times 100$$

6.2 Results of Breeding Source Surveillance

Low Rise Buildings

Figure 1 shows the breeding activity of *Aedes* mosquitoes at the construction site of the market complex in Bayan Baru. The container index (CI) was zero in the first week but increased drastically in the second and third week as construction activities increased. The first spraying activity was carried out in the fourth week. The CI decreased to zero the following week and no mosquito breeding was observed until the seventh week. The CI has increased slightly to 2.13 in the eighth week. This was due to the heavy rainfall recorded between the seventh and eighth week, which might have diluted the chemical, sprayed. The CI declined to zero at the ninth week, and

began to increase again at the tenth week where the second spraying was carried out. The CI started to decrease to zero from the eleventh week up to the thirteenth week. The third spraying activity was carried out on the thirteenth week. The CI remained at zero up to the fifteenth week when monitoring of *Aedes* breeding ceased.

Figure 1: The Container Index (CI) of *Aedes* Breeding at the Bayan Baru Market Complex. Arrows Indicate the Time where Spraying Activity was Carried Out with Sumithion 40 WP.

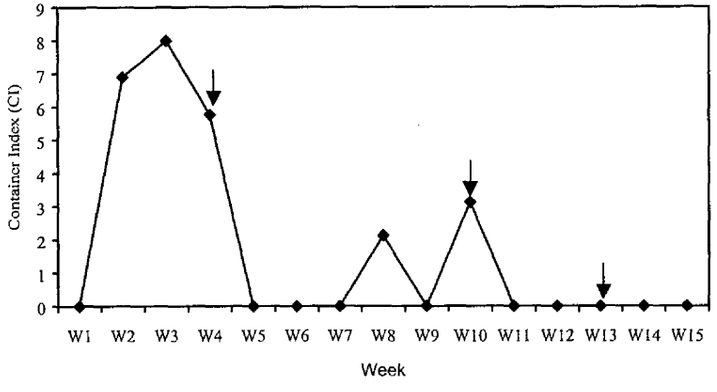


Figure 2: The Container Index (CI) of *Aedes* Breeding at Bukit Jambul Shopping Complex. Arrows Indicate the Time when Spraying Activity was Carried Out with Sumithion 40 WP.

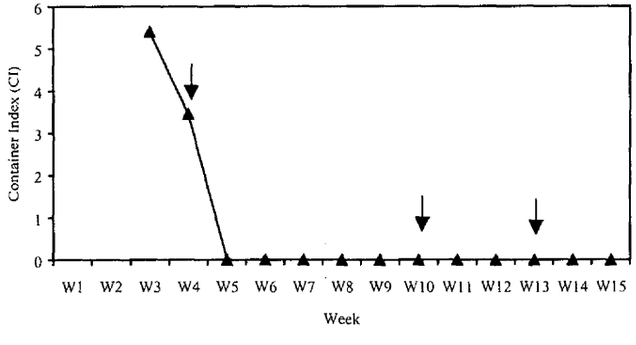
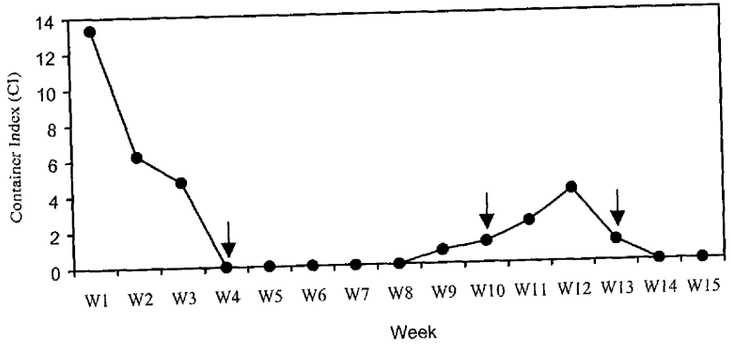


Figure 2 shows the CI of the construction site at the housing complex in Bukit Jambul. The CI decreased from 5.4 in the third week and touched 0 at the fifth week. This is probably due to the clearance of the field in preparation for the chemical treatment. It is generally found that the breeding of the mosquitoes was not heavy in

low-rise housing areas as compared to the high-rise buildings. The first spraying was carried out on the fourth week. The CI decreased to zero at the fifth week and stayed constantly zero onwards up to the tenth week. The second spraying was carried out on the tenth week and the third spraying was carried out on the thirteenth week. It seems that the chemical used was very effective at this construction site. Control of mosquito breeding in this area was easier because it only comprised of double storey building and is located adjacent to residential areas with no surrounding vegetation.

Figure 3 shows the CI value of the construction site at the low-rise apartments in Batu Maung. The CI decreased from the first week until the fourth week probably due to the clearance of the field preparing for the chemical treatment. The breeding source was cleared and so, the CI decreased from 13.3 in the first week to 6.3 in the second week, 4.8 in the third week and 0 in the fourth week. When the first spraying was carried out at the fourth week, the CI was found to be zero, which continued up to the eighth week. However, there was a slight increase in the CI from the ninth week that is 0.7. The second spraying of insecticide was carried out on the tenth week. Despite spraying of insecticide, the CI started to increase slightly to 1.2. This is probably due to the heavy rainfall at the tenth and eleventh week, which might have diluted the insectidal effect. The CI value started to drop again after the twelfth week from 4 to 1.2 at the thirteenth week. The third spraying activity was carried out on the thirteenth week. The container index decreased to zero toward the fifteenth week.

Figure 3: The Container Index (CI) of *Aedes* Breeding at Batu Maung Low-rise Apartments. Arrows Indicate the Time where Spraying Activity was Carried Out with Sumithion 40 WP.



High Rise Buildings

Figure 4 shows the CI of the construction site at the high-rise apartments in Batu Maung. The CI started at 3.2 at the second week. Then, it rose to 9 at the third week but decreased to zero at the fourth week. The first spraying activity was carried out at the fourth week. The CI remained zero until the fifteenth week. The second and third spraying activity was done at the tenth and thirteenth week, respectively. The CI remained at zero since initiation of spraying at the site.

Figure 4: The Container Index of *Aedes* Breeding at Batu Maung High-rise Apartment. Arrows Indicate the Time where Spraying Activity was Carried Out with Sumithion 40 WP.

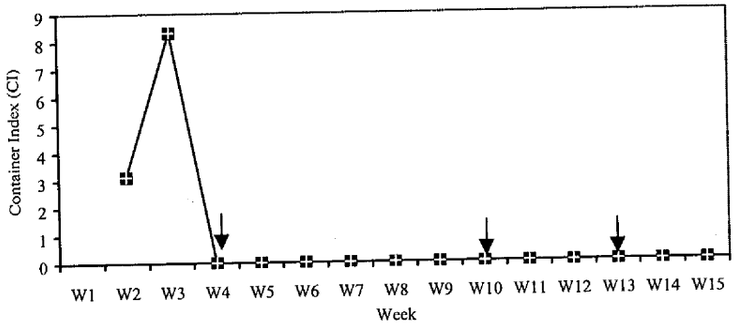
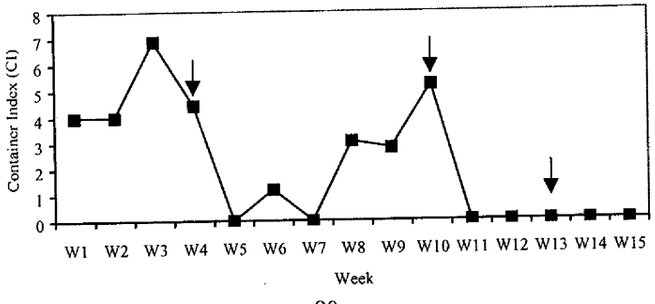


Figure 5 shows the CI of the construction site at Bukit Jambul high-rise apartments. The CI increased slightly from 4 in the first week to 6.9 in the third week. The first spraying was carried out on the fourth week. The CI dropped to zero at the fifth week but increased a little to 1.2 at the sixth week. It dropped again to zero at the seventh week. The CI then started to increase again from 3.1 at the eighth week then declined to 2.9 at the ninth week. However, it increased to 5.2 at the tenth week. The human activities of the workers who lived on the fifth floor in Block B of the construction sites contributed to high intensity of *Aedes* mosquito breeding at the semi-completed apartments. The site is surrounded by vegetation, which usually harbor adult *Aedes* mosquitoes. These female mosquitoes could come to the construction site to have blood meal and lay their eggs in the building. The breeding sites for the mosquito are usually the flooded floors and the balconies. The fluctuations in the CI could be due to the rainfall that might have diluted the effect of chemical sprayed. The second spraying activity was carried out on the tenth week. The CI started to decrease to zero at the eleventh week. It remained constantly zero onwards up to the fifteenth week. The third spraying activity was carried out on the thirteenth week.

Figure 5: The Container Index (CI) of *Aedes* Breeding at Bukit Jambul High-rise Apartment. Arrows Indicate the Time where Spraying Activity was Carried Out with Sumithion 40 WP



6.3 Discussion of Surveillance Results

The CI index showed that regular spraying of insecticide at larval breeding places help to reduce the *Aedes* larval population in the construction sites. However their effectiveness (efficacy) vary from one construction site to another depending on the cooperation from management, the workers, and the anti-mosquito team as well as the cleanliness and location of the sites. We found that the management of all the sites studied was cooperative and compliant with our recommended technology for mosquito control. When the management worked closely with us, the CI for *Aedes* breeding in their construction sites was low or zero when spraying activities were carried out. The anti-mosquito teams were trained to look for *Aedes* larval breeding sites and to spray these places with Sumithion WP 40 (recommended insecticide). The construction sites at Batu Maung and Bayan Baru in particular showed zero or low CI values after the spraying of the insecticide.

Other factors are also important in the intervention for dengue control at the construction sites. Cleanliness plays a crucial role in reducing or control of *Aedes* breeding in construction sites. Garbage disposal must be regular to eliminate potential sources of *Aedes* breeding. Those construction sites (Batu Maung and Bayan Baru) practised some form of garbage disposal and the CI index was significantly lower in breeding sources (zero or low CI) as compared to the other sites. On the other hand, in Bukit Jambul high-rise buildings where workers were housed in the incomplete buildings without any proper garbage disposal system the CI was high within a short period of time after spraying of Sumithion WP 40. The high-rise building at Bukit Jambul also posed a problem for inspection of *Aedes* breeding places.

The surroundings of the construction sites are another factor that must be considered in intervention for dengue control in these areas. Dense vegetation around a construction site has an effect on the population of *Aedes* mosquito. Construction sites that were surrounded by vegetation usually have high *Aedes* mosquito population. Batu Maung and Bukit Jambul high-rise apartments are two construction sites with vegetation around them.

7. STRENGTHS AND WEAKNESSES OF THE STUDY

Past efforts designed to prevent dengue infection have mainly centered on informing the public on the range of chemicals available and potential mosquito breeding areas. It is assumed that if the target audience is adequately informed they would take the appropriate action. Unfortunately information alone does not necessarily bring about behavioural change. It is not enough to convince people to change; they need guidance on how to translate their concern into actions. Self-efficacy is about people's skills and beliefs that their action can bring about change to their environment. In this research, developing self-efficacy has been incorporated by providing the resources to implementing regular spraying and by constant feedback to

site supervisors and anti-mosquito team members that regular spraying did indeed lower the incidence of *Aedes* mosquito larvae.

Overall the research team received good cooperation from the management of the study sites. Management was open to ideas and suggestions in improving control activities in construction sites. This is partly due to the good rapport between researchers and contractors, site supervisors and workers active in the anti-mosquito teams. As a result of the research intervention, management switched from oiling which tend to pollute the environment to the use of the recommended technology, which comprised the appropriate chemical. Management also gave support to the training of the anti-mosquito team, and welcomed weekly feedback on larval surveillance results. Through these intervention efforts, management was convinced that control measures need not be costly and difficult to implement. Hence, the research found that with management cooperation, proper training of anti-mosquito team and regular feedback resulted in compliance in regular spraying leading to significant reduction in the incidence of larval breeding at construction sites.

Maintaining cleanliness of the construction sites posed as a serious problem and the study did not obtain commendable results in this respect. Most of these sites did not have a proper method of rubbish collection and disposal. It was found that management gave little attention to cleanliness and did not follow-up on maintaining cleanliness of the site even though this was repeatedly highlighted and emphasized by the research team. Facilities such as rubbish bins, proper rubbish disposal system were lacking in all the sites. There was also inadequate cooperation among workers mainly attributed to the poor communication and lack of encouragement from management, etc. The problem was further aggravated by the presence of '*kongsi*' housing within the site. Cleanliness of the site is crucial to reducing sources of breeding from water-holding containers. We found that convincing safety officers/site supervisors and members of the anti-mosquito teams of the need to maintain cleanliness of the site is not sufficient. Cleanliness of the construction site requires the cooperation of top management and workers alike. For the health of those living within and around the construction sites, the relevant authorities and management have to work together to implement a regular rubbish disposal system that is effective and economical. Regular spraying of appropriate larvicides and proper garbage disposal system would go a long way in ensuring a clean, healthy and dengue-free environment.

The anti-mosquito team requires management support as their effort is complicated by ethnic loyalty and loyalty to different sub-contractors. Top management needs to be convinced that allocation, time and personnel need to be assigned to ensure the cleanliness of the site. It should be considered a norm that an anti-mosquito squad is appointed in all construction sites and that each new batch of workers is informed on the safety and cleanliness procedures. Informal leaders and site supervisors should implement cleanliness rules reinforced by regular '*gotong-royong*' activities, to ensure adherence. Top management should also implement the norm that sub-

contractors are responsible for their workers and that they should ensure that their workers follow the cleanliness procedure of the site.

Health training through talks and video were also carried out among the workers and management. In each of the study site it was only possible for us to carry out one health talk, one video and discussion session. This is evidently insufficient as workers moved from site to site. At the very minimum it is imperative for every contractor to hold health-training sessions with each new recruitment of workers. The survey data showed that workers who had participated in training activities indicated higher knowledge of mosquito control activities and reported adoption of control measures such as reducing mosquito-breeding sources. Although we cannot conclude that the intervention had direct impact on this behaviour, there were indications that workers were better informed on mosquito control. The data confirmed that there was some increase in knowledge level on topics that the health training focused on. Language is a major hindrance in the implementation of the training sessions.

Encouragement to management can also be done through the way fines are being implemented. Fines should be carried out firmly and fairly. For some, it is only through heavy penalty that they will take action. However, care should be taken that fines and penalty do not act as deterrents to positive action. The imposition of fine should be able to discriminate between those who have taken action but through oversight neglected one or two water-bearing containers, and those who did not bother to implement any proactive activities to control *Aedes*.

The research team had used a modified evaluation design due to operational limitation as most of the workers were attached to sub-contractors specializing in specific construction activities and tended to 'shift' from site to site on completion of their assignments. We became aware of this factor in the midst of the study, which obviously compromised our study design, as we could not follow our original plan to use the experimental design. Hence while a more systematically controlled design is needed to make any conclusive findings, the results of the pre and post-survey on the knowledge, attitude and practice levels of the target audiences remain useful indicators of the potential effects of the intervention activities.

8. RECOMMENDATIONS

- Health education and training

  It is recommended that the health authorities support management in conducting regular health education and training for their workers. Health education and training should be done at the initial phase of the project. Support should also include supplies of relevant materials in the languages that the workers can understand.

- Emphasize the key role of management

  Management has a key role to play in control activities. The first task is in organizing and monitoring control activities such as spraying or fogging. Management should also impose rules on maintaining cleanliness of the construction site, especially in '*kongsi*' houses. They must play the crucial role in promoting and facilitating general cleanliness of the site such as providing rubbish bins, encouraging workers to practice source reduction, etc. Management should also commit time and manpower to carry out anti-mosquito activities.

- Formation of in-house mosquito team

  Formation of an anti-mosquito team at each construction site is useful to ensure that a few motivated workers are trained on the appropriate dosage of the recommended insecticide, proper spraying technique, identification of breeding places for spraying and safety measures when using the insecticide. Team members could also serve as role models to their other co-workers by taking responsibility to carry out preventive activities such as spraying and source reduction. Thus, it is recommended that each construction site be required to form an anti-mosquito team at the onset of project and make this known to all the workers. Support and recognition of the team by management and workers must be ensured. In selection of the anti-mosquito team members, the following criteria are suggested to management: (a) the members should be responsible and reliable, (b) they comprise a multi-ethnic team to ensure cooperation of workers from all ethnic groups and (c) the selected workers should be given priority for future employment by the company in other construction projects to ensure sustainability of the skills learnt.

- Establishing an effective rubbish disposal system

  There is a need to establish a proper system of rubbish disposal and to impose certain regulations that would facilitate compliance of management. Management should find ways to gain cooperation of workers in maintaining the cleanliness of the site. There is a need to review the provision of '*kongsi*' housing that on one hand benefit workers but pose as a real health hazard because of poor sanitation and hygiene. As such it is recommended that the health authorities examine this issue in order to identify a feasible solution to this problem.

- Recommend effective and appropriate technology for mosquito control

  It is recommended that management and contractors be given advise on the appropriate larvicides to use to control mosquito breeding at the construction sites. Two alternative larvicides are recommended, i.e., Sumithion WP 40 and Baytex. Clear instructions for use and safety measures should be provided. Oiling water surfaces with used diesel oil should not be recommended. Source reduction must be emphasized in order to reduce *Aedes* larval breeding more effectively in

addition to regular insecticide spraying. Cleanliness and good site sanitation should be promoted to reduce vector breeding.

- Regular larval surveillance to monitor *Aedes* breeding at the construction site

  Management, contractors, site supervisors and members of anti-mosquito team be trained to carry out regular larval surveillance to monitor *Aedes* breeding.

- Follow-up activities by health authorities

  It is recommended that health authorities provide regular supervision and feedback on control activities and mosquito breeding conditions to management and anti-mosquito team members.

- Health authorities maintain good rapport with management

  The study revealed that management and contractors could be persuaded and motivated to carry out more systematic and improved control of mosquito breeding at the construction sites. Approaching management in a cordial way with the goal and attitude of working along with them has very positive results. Thus, it is recommended that health personnel adopt this attitude and practice working along with the management rather than just as law enforcers. Health authorities can support management by providing regular feedback on the results of their surveillance of *Aedes* mosquito larvae and potential breeding grounds.

Enforcement/Legislation

It is recommended that specific rules on mosquito and dengue control be incorporated in the Document Tender (Award of Contract) such as:

- Formation of in-house mosquito team. (This condition has been included by some local authorities but not effectively enforced).
- Management to provide cooperation to health authorities in health education and training.
- Costs for mosquito control and maintenance of cleanliness of the site to be included in contract.
- Rules on health and cleanliness to be included in contract.

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PAR IN DENGUE CONTROL: A CASE STUDY OF TWO RURAL COMMUNITIES IN SARAWAK[1]

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1. INTRODUCTION

This research is part of a nation-wide study coordinated by the Institute of Medical Research. It is a collaborative study by the Sarawak State Health Department and the Faculty of Social Sciences, Universiti Malaysia Sarawak (UNIMAS). The researchers from the Sarawak State Health Department contributed their expertise in epidemiology, entomology, health education and health promotion. UNIMAS contributed their expertise in the social and behavioural sciences.

In the past, the Sarawak Health Department had initiated community-based efforts in the control of dengue in the urban areas with varying success. The experience of Sibu in controlling dengue using the community-based approach was initially successful with the commitment of the local political leadership. But in the ensuing years, sustainability of the project was difficult to maintain.

A study on a community-based intervention in dengue control in a rural area of Sarawak was thus timely, the results of which can be used later to prevent the spread of dengue in the rural areas of Sarawak. This paper offers an overview of a community participatory approach used in dengue prevention work in Sarawak.

2. BACKGROUND OF THE INTERVENTION VILLAGES

Kampung Beradek and Kampung Semilang are located along the Kuching district coastal area and are linked by water transportation to the main land. The nearest town from the villages is Kuching city center. The coastal port servicing both these villages and other nearby coastal villages is known as Gobelt which is about 15 to 20 minutes by boat from both villages and another half an hour from Kuching.

Both villages are situated alongside each other, so the villagers can walk between these two villages in about 5 to 10 minutes. The villages have their own defining land boundary and administration system. The landscape of both the villages commonly has coconut trees, shrubs and bushes. The villagers prefer to build houses in groups far away from their farms. Most of the villagers' houses are on Native Customary

[1] Adapted from "Promoting Behavioural Changes in the Control of Dengue and Dengue Haemorrhagic Fever in Sarawak - A Participatory Action Research Approach" Final Report by Sarawak State Health Department, Kuching Divisional Health Office, University Malaysia Sarawak. Authors: Abdul Kadir Anis, Andrew Kiyu, Asmad Matusop, Christina Misa Wong, Faizah Mas'ud, Jerah Jemau, Kamaliah Mohamad Noh, Mohamad Taha Arif, Peter Betong, Pises Busu, Rose Bong, Sara Ashencaen Crabtree. Edited by Asmad Matusop, Faizah Mas'ud, Kamaliah Mohamad Noh, Pises Busu.

Right land while the farms are on Mixed Zone land according to the Sarawak Land Titles.

Both the village communities are Malay with Islam as their religion. There is only one Chinese family living in Kampung Beradek. Kampung Beradek and Kampung Semilang have a population of less than 400 and less than 500 respectively. An important Malay community characteristic is the patriarchal system, where men play important roles as decision makers, breadwinners and political actors. Women's roles are mostly child caring and household activities. The community's daily routine is influenced heavily by their belief system.

Each village is led by a village leader and supported by sub-committees. The committee members have power to make decisions on project implementation and organizing the people for communal activities as well as to take care and administer the community's well-being and needs. The villagers in turn must respect and agree on the committees' decisions. The sub-committees in both villages represent various sections of the community. Any project or research undertaking requires the approval of the village committee.

These two villages have their own community hall, a mosque, a few playgrounds and a soccer field. One primary school is built to accommodate children from the two villages. However both villages do not have tar roads.

The two villages also do not fully have the essential utilities like electricity and treated water supply. Only two-thirds of the villagers enjoy electricity supply. The only safe water supply for drinking comes from rain water. Water from the wells is only used for household cleaning as it is brownish and has an unpleasant odour. The villagers have to store water during rainy seasons to meet daily needs.

Both the villages do not have adequate communication. There is neither postal service nor public telephones. One individual from Kampung Semilang is responsible for all postal services between the two villages and Kuching Post Office. The villages are served by the mobile village health team from the Kuching Health Office on a monthly basis.

Agriculture and fishing activities are the main sources of income in both villages. Agricultural activities involve coconut and paddy planting, vegetable gardening and growing fruit trees. Fishing activities are carried out in nearby rivers using small boats. Currently, the village youths prefer to work in the factories, government agencies, and private sector or as manual labourers.

The Federal agencies responsible for the development of both villages include the Ministry of Rural Development, the Departments of Health, Agriculture, Fishery and Land & Survey. The operational areas are mainly in sanitation, agriculture, fishery, infrastructure and housing. A unique development project is the Integrated Agriculture Development Project (IADP) that has the support of stage agencies

(North Kuching City Council, SESCO and others). Community development projects for income generation focus mainly on agriculture and fishery, while basic infrastructure projects such as pavements, bridges and housing and a sanitation project to provide a toilet for every household were implemented by the Ministry of Rural Development.

Among the projects that have been implemented in agriculture are self-help and income generating projects and fishing licensing. Health projects encompass rain water tanks, community family planning and health promotion. Rural development has facilitated the provision of toilets, walk pavements, electricity and housing for the poor.

Besides supervision and advice in the various development projects, the government agencies' roles in both villages are crucial in providing training for a self-sufficient, healthy and well developed rural community.

3. STUDY APPROACH

Dengue prevention programmes involve environmental, water and garbage control. These interventions are simple and involve the individual, the household and the community (Kendall, 1998). However, there are complex social and technical factors involved in prevention and which make it a determinant of health and disease (Schwab & Syme, 1997). These social and technical interventions have to be explored and acted upon and can be done through the participatory action research approach.

This project had adopted participatory approaches to the community health development in planning, implementing and evaluating a dengue prevention programme. Integrated community activities were planned to achieve the objective of controlling dengue vectors. The participatory action research (PAR) approach was used to get the involvement of the community in the identification of problems and subsequently in solving them.

PAR is defined as "a process of systematic inquiry, in which those who are experiencing a problematic situation in a community or workplace participate collaboratively with trained researchers as subjects, in deciding the focus of knowledge generation, in collecting and analyzing information and in taking action to manage, improve, or solve their problem situation" (Deshler & Ewert, 1998).

PAR is essentially an approach and method that is used to enable the local community to share, enhance, and analyse knowledge of their life and conditions. Through that analysis, the community can then plan, act, monitor and evaluate a programme that will best address the problems in their community. The objective of this approach is to equip the community with confidence and motivation so that they themselves can

initiate a process of empowerment and instill a sense of ownership towards the intervention programme (Wong, 1997).

Towards this objective, health promotion strategies using improved communication strategies, training and social mobilisation through focus discussions were employed.

4. METHODOLOGY

4.1 Focus Group Discussions

The knowledge, attitude and practice of the population concerned are assessed through focus group discussions and interviews. Focus group discussions (FGD) have been extensively used in commercial market research as a means of obtaining a variety of views on a given theme or topic. The assumption behind the use of this form of data collection is that opinions develop in the social group and not in a vacuum of personal observation. Opinions are frequently formed during the active participation of a group discussion and therefore a liberal, permissive atmosphere among peers is a good environment in which to gather views and information (Marshall, 1995).

Focus group discussions were conducted to understand each group's beliefs, knowledge and practices in relation to the problems and solutions that exist in the community with regard to issues surrounding dengue. Insufficient information, skills and knowledge to deal with a problem are common communication obstacles in many communities. Cultural beliefs and practices can also be barriers to tackling problems even when the knowledge and other requirements for a solution are in place. Knowing the group's beliefs, knowledge and practices will provide answers to the questions: why do people make decisions to act in certain ways and on what basis?

Understanding whether the problem is brought about by lack of knowledge, cultural beliefs and practices is very important. There may be many misconceptions to the problem. For example, respondents in the focus group discussion thought that the transmission of dengue was through fecal-oral routes as well as through flies. They also thought that the *Aedes* mosquito had larger legs as compared to other types of mosquitoes. By conducting a focus group discussion to understand the level of knowledge, personal and group beliefs as well as practices, the researcher can then understand why individuals and groups behave in a certain way.

FGD is based on the premise that each person's views are valid within the given context and to be held in equal weight with other participants. FGD requires that the area of investigation needs to have undergone some preliminary analysis in order for participants to be selected within homogeneous criteria. In the dengue prevention project, for example, the original hypothesis formulated was that residents living at Kampung Beradek and Kampung Semilang were not familiar with the nature of the disease or how to prevent it.

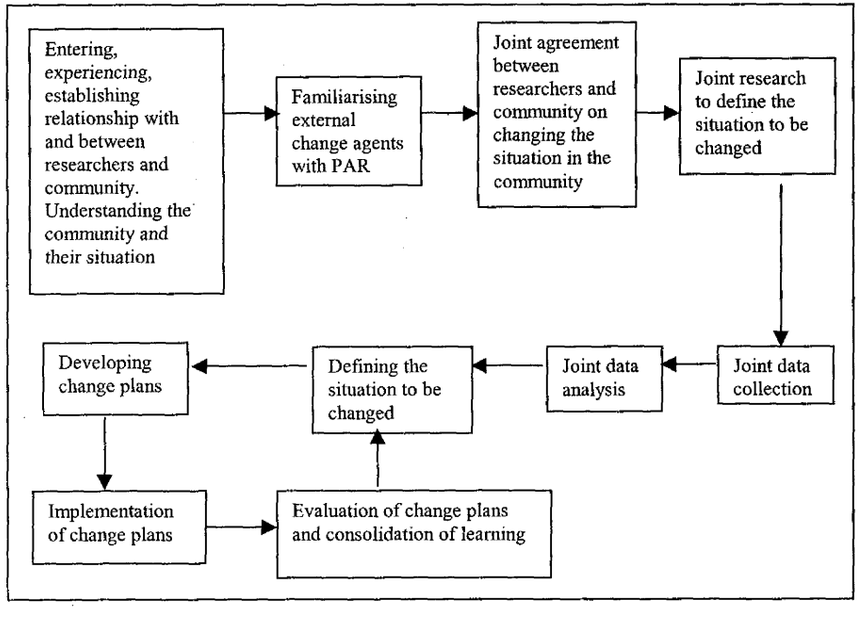
The selection of participants needs to reflect the structure of the communities, e.g., hierarchy and other social stratification. Additionally the diverse experiences of groups of residents require investigation, e.g., in relation to gender differences; and finally, diversity of viewpoints based on established patterns of living compared to experimental and developing, e.g., mature residents compared to youths and children.

4.2 Participatory Action Research

In this project, the PAR approach can be divided into five phases (Figure A). There is no set framework for doing PAR (Smith, 1997). There are many variations to doing PAR but at the core of the approach is a joint inquiry process between change agents and the community, to take action on a situation that has been determined as problematic.

A step model has also been developed for this project and is shown in Figure A.

Figure A: Model of the Participatory Action Research (PAR) in Kampung Semilang and Kampung Beradek – 1997-1998



Here, the first step of the PAR approach is "Entering, Experiencing and Establishing Relationship". Without this step, doing PAR cannot start (Smith, 1997). This figure also shows that there are four steps that are revolving around a continuous cycle. These four steps are: defining the situation to be changed, developing change plans, implementation of change plans, evaluation of change plans and consolidation of

learning. It is important to note that in PAR, people learn from their experience, and it is from experience, reflection and evaluation that change is brought about to reflect the current situation. PAR is never static, it is always transforming because engagement in PAR is "an encounter with reality and with possibility" (Smith, 1997).

The five main phases of doing the participatory action research in the dengue prevention project in Kampung Semilang and Kampung Beradek are:

Phase 1: Organisation of the project and knowledge of the community (Preliminary Phase)

The external researcher enters a community and gathers and analyses information about the community and its main problems. This is done through focus group discussions, knowledge, attitude and practice (KAP) studies, informal and formal interactions. Upon being accepted, the external researcher explains the purpose of the project and comes into agreement with the community regarding their involvement.

Training of change agents is an essential and crucial part of the project. The training of change agents to encourage and assist in evolving people's initiatives does not only require good facilitation skills but also close rapport with the community. Furthermore, personal motivation and interest in promoting people's initiatives are important criteria for the role of change agents in this project.

The external change agents were chosen carefully by the research team and came from a variety of background and training. A total of 15 health care personnel were chosen and included health inspectors, medical assistants, a community nurse, a public health nurse, a health education officer, junior hospital assistants, public health assistants, and a general worker.

These change agents were trained and familiarised with PAR. They also underwent a workshop that they replicated at the community level in phase two. The general objective of this workshop was to familiarise and train external change agents to acquire knowledge and skills to initiate, implement and evaluate a dengue prevention programme based on the PAR approach with the community. Participants of the workshop also developed new skills in adult training methodologies, experiential learning, community mobilisation and organisation techniques. The participants were also put through the same exercises and activities that they later implemented at the community level.

Phase 2: Defining the problems, conducting research, gathering data and analysis (community workshop – training of internal change agents).

Following the training of external change agents, the change agents went to the communities to explain and obtain consent for a similar workshop to be held at the community level, involving the selected members of the community. The selection of the internal change agents were done by the community themselves.

At the community level, the aim of the workshop was to train internal change agents from the community to conduct their own needs assessment and plan a programme from the results of the needs assessment.

The internal change agents undergo a workshop to assess the situation and to identify problems in the community that need to be investigated. Throughout the workshop, dialogue and problem posing techniques are used to explore factual, interpersonal and critical knowledge. Participants link their interpretations of the problem to the broader context. The group conducts research to understand the problem through dialogue with the community and conducting a survey to collect data. The data analysis enables the participants to discover various dimensions of the problem and to use these to find solutions.

Phase 3: Definition of action (Planning)

Once solutions to the problem have been brainstormed, the group identifies and plans meaningful and appropriate actions to take.

From the workshop findings, plans were developed for the dengue prevention programme by the internal change agents. Dialogues were held between internal change agents in their own community with the village development committee, zone leaders, as well as the different sub- committees in the planning of activities for the programme. Most of these activities centered on initiating and maintaining cleanliness of the house, zone and community areas as well as reducing breeding places. As an incentive to the villagers, competitions were organised between zones in the villages on environmental sanitation. Zoning of the villages was deemed necessary by the villagers for easier management to increase participation by villagers and also to develop competitive spirit and teamwork.

For Kampung Beradek, there were plans to hold '*gotong-royong*' sessions by each zone in the community and houses were to be inspected for potential breeding sites. A plan was also drawn up to cement the top of the septic tanks because rainwater accumulates there and is a source of concern. A campaign for school children on dengue prevention was also planned and spearheaded by the Parent-Teacher Association. This campaign specifically focused on environmental cleanliness and awareness of dengue and breeding sites of the *Aedes* mosquito. Other strategies included holding a competition for the house with the cleanest environment, burning of rubbish and cleaning of the walkways as well as to put up more rubbish bins by the side of the walkways so that pedestrians can throw in the rubbish.

In Kampung Semilang, the internal change agents planned an exhibition and health talk on dengue, as well as a competition for the zone/house with the cleanest environment and *'gotong-royong'* activities by zone. Each zone designed its own banner and signboard and a competition was held for the most creative banner and signboard.

Phase 4: Action (Implementation)

The group goes into action. Action can occur simultaneously with more research and can lead to joint ventures and political alliances within the community as well as with other agencies.

In the two months leading up to the launching day of the project in May 1998, the above plans were all carried out except for the cementing of the septic tanks. Walkways were cleaned up, zones carried out '*gotong-royong*' activities, rubbish bins made of discarded tins and plastic containers sprouted up next to walkways, each individual household cleaned up its compound, each zone had different and creative signboards reminding everyone to beware of dengue and to keep the environment clean. One zone put up a model of an *Aedes* mosquito by the entrance of their zone while other zones had made gateways with dengue prevention messages on them. There were signboards with the message "Do not litter" placed at strategic points. The health department also built an incinerator in each community for rubbish to be burnt more effectively.

Health education activities were also done with the help of resources from the Health Department targeted for the whole village. The schoolchildren were especially targeted for health education activities to increase awareness on environmental cleanliness with competitions organised on this theme.

The week before the launching of the project, health education videos on dengue prevention were shown in between film shows to attract the public. The local primary school also hosted a story telling competition for the children and created awareness of dengue as well.

The competitions for "environmental cleanliness" and "the most creative banner" culminated with the launching of the project on the 30th of May 1998 held at the primary school in Kampung Beradek. The launching was organised by the two communities together with the teachers from the primary school, and was officiated by the local State Assemblyman and the Director of the Sarawak Health Department. There was much publicity during the launching with many agencies being represented - Radio Television Malaysia, Utusan Sarawak, and the Information Department. Prizes were given for the competitions in each zone as well as for competitions held by the primary school for their students. The internal change agents also received their certificates for participating in the workshops. Other activities held in conjunction with the launching included health screening conducted by the Health Department, an exhibition on dengue prevention as well as lunch that was cooked and served by the communities.

Phase 5: Evaluation

The group deliberated over what will be evaluated. The analysis of the evaluation was used to reassess and improve on the actions taken.

Preliminary evaluation held eight months after the workshop centered on focus group discussions with the village development committees (JKKK), women's groups and youth groups of the two communities. The preliminary evaluation assessed the participation level of the community in this project.

4.3 Environmental and Entomological Study

Environmental and entomological surveys were carried out to collect baseline data during the implementation phase. Entomological survey is an important and integral part of dengue prevention and control. In this project, the effect of the intervention by the community can be indirectly measured in terms of the degree of environmental modification that has taken place and directly or indirectly affected the ecology of the vectors that is the *Aedes* mosquitoes. The behaviour of these vectors and their close association with human habitation is an important consideration in choosing certain parameters to be measured. Thus, specific indicators like *Aedes* Index, *Breteau* Index and Container Index derived during the pre- and post-intervention period of the project will provide some indication of the impact of this experimental community participation study.

Baseline, post-intervention (three months after intervention) and post-intervention follow-up surveys were carried out to determine the *Aedes* breeding pattern and basic environmental condition as well as the sustainability of the activities.

Inspections were carried out indoor and outdoor for any breeding receptacles and collecting mosquito immatures along the way in polyethylene bags.

In addition to premises inspection, oviposition traps were set up in the villages. These ovitraps were collected one week after they were set. All the immatures were brought back to the laboratory for rearing and identification.

4.4 Knowledge-Attitude-Practice Study

A knowledge attitude and practice study was conducted on the two intervention communities as well as the control community. The questionnaire was interviewer administered. The interviewers were the health staff trained by the researcher in administering the questionnaire. The respondents were all heads of households in both the intervention and the control areas. Where the head of the family was not available during the interview, the second most influential person in the family was interviewed.

Baseline and post-intervention interviews were carried out. The respondents in the pre-intervention and post-intervention surveys may be different depending on who were present at the time of the interview.

4.5 Community Study, Informal and Formal Interactions

A community study was conducted through direct observation and informal interviews with key informants. These two social survey methods were used for the first part of the community study in this project. Both of these methods fall under informal social research (Nicholas, 1991; Feuerstein, 1986).

Based on the information gathered using these two methods, follow up in depth research was planned. Other informal interaction with the groups in the communities were made through visiting the homes of people, talking to people by the walkway, in the provision shop, and over meals. Indirect gathering of data was also done during the researcher's brief stay for the focus group discussion sessions. Past experience of the various research group members had also supplied crucial information about the community situation.

Formal interactions include the community nurse and the medical assistant conducting their clinics during village health teams. This phase of the study had been extremely important in building up rapport and trust with the communities to prepare a working relationship for the next phase.

4.6 Data Collection Methods and Analysis

The relevant information and data were collected by the individual collaborators. The qualitative data were collected from the FGD, the community study and the observations by the external researchers.

Quantitative data were from demographic variables for the community study, the KAP study and the entomological and environmental surveys.

Qualitative and quantitative analysis were made based on the specific objectives of the study. The quantitative data were analysed using the statistical package "Epi Info".

These activities yielded the following data and information:

- Ethnodemographic structure - Environmental and village infrastructure.
- Entomological indicators.
- Knowledge, perception, attitude and practices relating to *Aedes* breeding, causative factors and control.
- Observations on disease promotive behaviour and control of breeding areas.
- Descriptions on processes involved in motivating community to attend health.
- Promotive activities and their responses toward the health education materials and skills.
- Quantitative and qualitative observations on behaviour after the introduction of the above.

5. KEY FINDINGS

5.1 General Findings

From this study, it was found that the PAR approach was a feasible approach and was well accepted by the community. The PAR approach and FGD were useful tools in this community intervention study. The approach required intensive planning, involved many parties and utilised various processes. There was increased community participation in terms of leadership, management, resource mobilisation and organisation.

Although the knowledge of the community on dengue had not improved, there was an improvement in attitude and hence practices. This was revealed by the improved general environment of the villages which indicated better sanitary practices after the intervention. The intensified community participation led to marked reduction in *Aedes* breeding indices during the intervention phase.

However, the follow up entomological surveys called into question the sustainability of the community participation activities in *Aedes* control.

5.2 Specific Key Findings

- The study methodology, participatory action research (PAR), is found to be feasible and acceptable to the community. The results are encouraging in terms of reducing *Aedes* breeding although the approach requires intensive planning, involving many parties and various processes, and sustainability may be a problem.

  At the beginning of the project the communities evidently did not feel that the need for such a project was a priority issue. Aims and objectives of the project were still in their infancy and at that time the communities involved may not have been as prepared or as clear of the direction of the project as they were at a later date. Furthermore at the initial stages the external change agents and the researchers may have had a stronger stakehold in this project, with a clearer understanding of the importance of such a programme. From the communities' point of view lower priorities afforded to the programme were no doubt due to the general lack of awareness of the risk of dengue in their immediate environment, the hazardous nature of the disease, the impact of the disease on the wider community and related social consequences.

  Within a relatively short period of introducing the PAR programme however, the priorities of both communities changed and a far greater level of enthusiasm and participation was observed. There was increased community participation in terms of leadership, management, resource mobilisation and organisation.

- The focus group discussion (FGD) is a useful tool in this community intervention study.

Based on the responses from the FGD carried out at the initial stage of the project, the indications were that the time was right for community participatory action on dengue prevention. Initiatives and guidance were expected to be forthcoming from the health authorities, as was a shared responsibility for prevention activities. The water storage and toilet facility considerations needed to be urgently addressed because at that time these represented a major stumbling block to any hope of success in reducing the *Aedes* index in these communities.

Table 1: Findings of the 1st FGD

Topic	Findings
1. Personal experiences of dengue	None of the respondents had any direct experience of dengue although some had heard of it through the media and other sources.
2. Identifying dengue symptoms	Most groups interviewed were unclear about the symptoms of dengue, although the JKKK appeared to have a more accurate knowledge of the disease than other groups in both communities.
3. Who is more likely to get dengue and why?	Responses varied to this question but generally it was agreed that young children and the elderly would be more susceptible to the disease. There was also a considerable amount of agreement that in fact, probably anyone could acquire it. There was some concern voiced by adult women at Semilang that maybe this was an infectious illness and could be 'spread easily'. Others wondered if dengue could be spread by guano in water storage containers or general dirt around living quarters.
4. What kinds of concern are there about mosquitoes?	Responses varied on how one might acquire dengue but many respondents regarded mosquitoes as a source of illness, though not a serious one.
5. What is known about mosquito behaviour?	Most people had noted that mosquitoes could be found breeding in cans and stagnant pools, although this had not caused undue concern. There was a variety of responses concerning when *Aedes* mosquitoes might bite, most stating that twilight and early evening were more dangerous than daytime. It should be noted that many respondents based their replies upon previous experiences of diseases that had struck the community, e.g., cholera.

Topic	Findings
6. What ways can we protect ourselves against dengue?	There was a general awareness that a dirty or untidy compound presented a health risk. There also seemed to be a genuine motivation to do something about this but with the expectation that the health authorities should initiate action.
7. What should be done if you think someone develops dengue?	There was an almost unanimous agreement that the victim should be sent to hospital as promptly as possible. It was furthermore indicated that a permanent health clinic would be a useful resource for the communities in the areas.
8. How many times can a person get dengue?	The majority of participants were unclear about this point.
9. Where are people getting information about dengue?	Many respondents had received patchy information about dengue from media reports, newspapers and magazines, radio and television coverage. This was seen as a more common form of information dissemination as opposed to information given through the health authorities, although this was also seen as useful. It should be emphasised that the information received through the media did not ensure that participants comprehended with any accuracy relevant details of the disease apart from its serious and life threatening nature.
10. Which other ways could people learn about dengue? What information would you like regarding dengue prevention?	Information was regarded as needed but this was requested in the form of talks and videos rather than leaflets. Pictorial images may be a better way to disseminate information rather than relying on the written word only, which participants seemed generally unenthusiastic about.
11. Who should be responsible for putting ideas into action?	The general view was that the first initiative should come from the health authorities in enlisting the help of residents to improve conditions in the community.

Topic	Findings
12. What other things could be done by the community?	*'Gotong-royong'* or community action was seen to be a very appropriate way to tackle insanitary conditions in the community. Personal responsibility in keeping the family's compound clean was also emphasised. Rubbish disposal and adequate water storage were considered to be a problem with which the community needed outside assistance.

In the second focus group discussion, after the implementation of the project, evidently both communities were motivated and rewarded by the apparent changes taking place around them. Some spoke with a sense of pride in the outward appearance of the community and were pleased with the compliments they had received from visitors. Any lapse therefore, from these high standards would be regarded as a potential source of public disgrace.

Table 2: Findings of 2nd FGD

Topic	Findings
1. Activities and programmes held since workshops	• *'Gotong-royong'* activities were described by all groups as having taken place regularly in order to generate a collective response to clearing of insanitary areas. • In Kampung Semilang the clearing of the river was described as having taken place, with group activities taking place on Fridays. • Beradek and Semilang areas were divided into zones, with a zone leader appointed to oversee sanitation in Beradek, and a Chairman elected in Semilang. • Dustbins have been placed along the footpath in Kampung Beradek. • Regular inspections of jars & containers were conducted in both communities. • A small donation sought from each family to help fund cleaning & clearing activities.
2. Feedback on usefulness of workshops	• Perceived by both communities to be very helpful. • Both communities commented on how particularly useful the village survey had been. • The increase in knowledge on dengue was considered most valuable and had produced desirable consequences, e.g., a cleaner, landscaped environment.
3. Project process: opinions of implementation	• Both communities expressed approval in the way the project had been carried out and no improvements were suggested.

Topic	Findings
4. Perceptions of project effectiveness	• Youths & teenagers from both communities evaluated success rate of 80% in changing community perceptions and behaviour. • A greater sense of personal responsibility was noted by both communities. • A greater sense of collective responsibility and community pride was also noted. • Willingness to participate in community activities was observed. • The consensus was that this change would be a permanent feature of community life.
5. Problems encountered	• Both communities felt that they had had insufficient materials to affect the necessary changes. Lack of equipment such as weed killer, hoes and grass cutters were noted. • Appropriate collection of rubbish for incineration was also considered to be a serious problem. • The initial problem of motivating individuals was finally overcome through concerted effort, discussions and persuasion. • Neither community felt that there had been any problems associated with government agencies.
6. Maintaining change	• Recent behavioural changes were viewed as a permanent state of affairs. These were aided by: • Regular meetings. • Regular *'gotong-royong'* activities. • Individual responsibility in maintaining hygiene in household compounds. • Proper collection and disposal of refuse. • Contribution of funds from families to assist in maintaining the changes brought about. • Kampung Beradek youths called for regular zone meetings every 3 months and follow-up by health personnel every 4 months. • Continuous guidance by the health authorities. • Kampung Beredek women called for regular inspection to be carried out by the health authorities. • Kampung Beradek JKKK called for refresher workshops to be carried out periodically with zone competitions annually. • Kampung Semilang women called for *'gotong-royong'* activities to be carried out on Fridays. • Kampung Semilang youths called for cleaning campaign

Topic	Findings
	with with assistance from government agencies annually.

- Sustainability

Follow-up entomological surveys indicate that the community participation activities in *Aedes* control have raised the question of sustainability.

The appreciation of the new hygiene and aesthetic standards led one facilitator to be concerned that for adult women in Kampung Beradek, may be the actual point of the exercise, namely to reduce the *Aedes* index, had been largely forgotten. With this in mind it might be advisable for health personnel to help the community to continue to identify the link between a cleaner environment and reducing the risk of dengue. The possible repercussions of failure to do so might be seen in an outward appearance of good order and sanitation but without reducing the *Aedes* index.

- Environmental and Entomological Assessment

Concerted and dedicated efforts by the community to modify and improve the environment appear to have reduced the breeding potential of *Aedes* mosquitoes to a certain extent. Although the reduction in the overall *Aedes* Index in the two intervention villages may be interpreted as coincidence and not as a direct result of the intervention measure which was introduced, (since similar reduction was also observed in the control village), this is expected to trigger greater awareness among the community members to improve further in future. (Table 3)

Table 3: Results of House Survey and *Aedes* Indices During Baseline, Post-intervention and Follow-up Surveys

Parameters	Kampung Beradek			Kampung Semilang			Kampung Sungai Aur (Control)		
	A	B	C	A	B	C	A	B	C
Houses surveyed	53	60	65	112	111	115	24	21	21
% $+^{ve}$ for *Aegypti*	60.4	13.3	21.5	77.7	18.9	18.3	0.0	0.0	0.0
% $+^{ve}$ for *Albopictus*	66.0	50.0	40.0	69.6	36.9	45.2	87.5	57.1	52.4

A - Baseline survey
B - Post-intervention survey
C - Follow-up intervention survey

Very encouraging results were demonstrated from the analysis of the Container Index. The marked reduction in the Container Index (from 27.5% to 8.5% in Kampung Beradek and from 35.4% to 11.7% in Kampung Semilang) indicate that the communities in these two villages have taken a more serious effort to prevent mosquito breeding by whatever means available, such as covering the containers with plastic sheets or by applying larvicide. The importance of preventing mosquito breeding in temporary containers need to be continuously emphasised in the coastal areas as long as there is a need to keep these containers for water storage. (Table 4)

Table 4: Results of Surveys on Containers and Container Index During Baseline, Post-intervention and Follow-up Surveys

Parameter	Kampung Beradek			Kampung Semilang			Kampung Sungai Aur (Control)		
	A	B	C	A	B	C	A	B	C
Houses surveyed	53	60	65	112	111	115	24	21	21
Water storage ($+^{ve}$)	536 (135) [25.2]	389 (31) [7.9]	383 (52) [13.6]	707 (233) [32.9]	369 (33) [8.9]	458 (64) [14.0]	109 (39) [35.8]	101 (24) [23.8]	70 (15) [21.4]
Dometic container ($+^{ve}$)	34 (11) [32.4]	46 (3) [6.5]	16 (4) [25]	58 (23) [39.7]	29 (5) [17.2]	58 (23) [39.7]	13 (5) [38.5]	14 (7) [50.0]	45 (1) [2.2]
Natural containers ($+^{ve}$)	0 (0) [0.0]	13 (1) [7.6]	3 (2) [66.7]	2 (1) [50.0]	7 (0) [0.0]	1 (0) [0.0]	1 (1) [100.0]	0 (0) [0.0]	1 (0) [0.0]
Total containers ($+^{ve}$)	596 (164) [27.5]	470 (40) [8.5]	418 (65) [15.6]	864 (306) [35.4]	427 (50) [11.7]	555 (111) [20.0]	147 (58) [39.5]	126 (35) [27.8]	126 (20) [15.9]

Table 5 provides a comparison of the difference in the Breteau Index during the baseline survey and the post-intervention and the follow-up intervention period for Kampung Beradek, Kampung Semilang and Kampung Sungai Aur. The result seems to indicate that there was a marked and rapid reduction in the proportion of containers with *aedes* breeding in the intervention villages during the post-intervention period. There was however a slight increase in the Breteau Index during the follow-up intervention period. The reduction in the control village was gradual.

Table 5: Results of Surveys on Containers and Breteau Index During Baseline, Post-intervention and Follow-up Surveys

Locality	Base-line Survey	Post-intervention Survey	Follow-up Intervention Survey
Kampung Beradek	309.4	66.7	75.0
Kampung Semilang	273.2	45.1	88.2
Kampung Sungai Aur	241.7	166.7	95.0

The result of the ovitrap survey in the three villages is presented below. The results show that there were decreases in the ovitrap indices in the intervention villages during the post- intervention and follow-up surveys. The ovitrap indices in these villages after the intervention were below 50%. On the other hand the ovitrap index in the control village remained high (over 50%) during the post and follow-up surveys.

Table 6: Results of Ovitrap Surveys and Ovitrap Index

Locality	No. of ovitraps set	Baseline survey		Post -intervention		Follow-up survey	
		No. Positive	Ovitrap Index	No. Positive	Ovitrap Index	No. Positive	Ovitrap Index
Kampung Beradek	60	30	50.0%	29	48.0%	29	48.3%
Kampung Semilang	60	39	65.0%	22	36.7%	26	43.3%
Kampung Sungai Aur	30	21	70.0%	22	73.3%	23	76.7%

Aedes breeding can be successfully reduced and controlled if most of the potential breeding places are removed as indicated during the first post-intervention entomological survey. Although other environmental factors may have contributed to the reduction in the various *Aedes* breeding indices, intensive and coordinated efforts by the community has undoubtedly contributed to this success.

Knowledge, Attitude and Practice

Although the knowledge of the community on dengue has not changed, the improvement in the general village sanitary conditions indicate better sanitary practice after the intervention.

The villagers had become more cooperative and have formed a cleaning campaign committee. Each village was divided into zones and a leader was chosen for each zone to oversee their '*gotong-royong*' activities. All the rubbish and tall bushes were cleared.

Kampung Beradek had improvised home-made rubbish bins out of empty tins and old unused water tanks. These were placed along all the footpaths for the people and school children to throw rubbish.

Knowledge

After the intervention phase, the respondents from the intervention area displayed satisfactory knowledge on the *Aedes* mosquito especially in general recognition of *Aedes*, breeding places and preventive measures against breeding. But there was a decrease in detailed recognition of *Aedes* and knowledge on *Aedes* biting habits and signs and symptoms of dengue fever. Interestingly, it was found that there was also an increase in knowledge of *Aedes* in the control area.

In the intervention area, respondents (N=130) who could recognise *Aedes* mosquitoes in general increased from 33.6% (40) to 49.6% (59). In the control area, those who could recognise *Aedes* mosquitoes in general increased from 73.7% (14) to 94.7% (18).

In the intervention villages, more than 90% (pre-intervention 98.3%[117], post-intervention 95.8%[114]) of the respondents knew about the breeding places of *Aedes* mosquito. However the number of respondents who knew that dirty water is not a breeding place was 47.9% (57) in the pre-intervention and 48.7% (58) in the post-intervention survey.

Knowledge of breeding places of respondents (N=19) in the control village increased from 52.6%(10) to 94.7%(18). However, the number of respondents who knew that dirty water is not a breeding place decreased from 15.8% (3) to 5.3% (1).

In the intervention area, those who knew all the measures to prevent breeding of *Aedes* mosquitoes also increased from 20% (26) to 21.5% (28). In the control area, those who knew all the preventive measures increased from 10.5% (2) to 31.5% (6).

In the intervention area, the respondents who knew of only one sign/symptom of dengue fever increased from 58.5% (76) in the pre-intervention study to 71.5% (93) in the post-intervention phase. In the control area the knowledge on two or three signs and symptoms of dengue fever showed an increase from 21%(4) in the pre-intervention phase to 89.5% (17) in the post-intervention.

Knowledge about the biting habit of *Aedes* mosquito was 32.3% (42) in the pre-intervention phase and 30.8% (40) in the post-intervention phase in the intervention area. In the control area this was 10.5% (2) and 84.2% (16) in the pre- and post-intervention phases, respectively.

Practice

The practices of residents in the intervention and control area showed improvement.

The intervention area showed a marked improvement in the practice of refuse disposal. The practice of throwing rubbish indiscriminately reduced from 55.4% (72) to 5.4% (7). The method of refuse disposal by burning and burying of empty containers increased from 44.6 % (58) to 94.6% (123). In the control area, the practice of rubbish disposal by burning also increased from 0% (0) to 52.6% (10).

In the intervention area, more than 90% (pre - 92.3%[120] and post - 91.5%[119]) of the respondents practiced at least one dengue prevention practice while in the control area, those who practiced at least one dengue prevention measure increased from 78.9% (15) to 94.7% (18).

In the intervention area, the practice of throwing away water and cleaning the water containers by scrubbing decreased slightly after the intervention phase, although it was still practised by more than 80% (pre - 90%[117] and post - 80.8%[105]) of the respondents. In the control area, those who changed the water and cleaned the water containers remained unchanged at 78.9% (15).

In the intervention area, the practice of washing the water containers once a week was still low at 36.9% (48) in both the pre- and post-intervention phases, while those in the control area who cleaned water containers weekly dropped from 15.8% (3) in the pre-intervention phase to nil in the post-intervention phase. This problem is related to the water supply from rain water in both the intervention and control areas.

More than 60% of the respondents in the intervention area and in the control area were still using jars to store water.

Among those who were using jars in the intervention area, about 90% in both pre- and post-survey covered the jars properly to avoid *Aedes* mosquitoes from entering. In the control area, the practice of covering the jars properly increased by 5.2% from 63.2% (12) in pre-intervention to 68.4% (13) in post-intervention phase.

In the intervention area, those who were involved in '*gotong-royong*' increased from 90% (117) to 91.5% (119) while in the control area the residents involved in '*gotong-royong*' also increased from 84.2 % (16) to 89.5% (17).

Attitude

Generally, respondents in both the intervention and control areas showed a positive attitude towards preventive practices, such cleaning water containers

weekly, use of Abate, proper refuse disposal. Respondents with a positive attitude in the intervention area increased from 62.3% (81) to 79.2% (103), while in the control area it increased from 31.6% (6) to 89.4% (17).

6. STRENGTHS AND WEAKNESSES OF PAR APPROACH

Dengue is largely a disease shaped by human activities and thus the risk of dengue transmission can be both escalated and reduced by human behaviour. In Malaysia control of risk-laden behaviour has usually been in the shape of public education and punitive actions, such as the enforced inspection of premises and heavy fines. As Gordon (1988) notes however, coercion is unlikely to accomplish compliance and where strategies can be devised to reward behavioural habits commensurate with lower health risks, these should be explored and followed.

6.1 Strengths

- The PAR approach used in this project appears to have successfully empowered the community to take charge of their own health development through involvement in needs assessment, programme planning and implementation. The community is the direct beneficiary of this project.

  Even though most people did not see dengue as a threat to their community during the first phase of the project, the external and internal change agents have created sufficient awareness to motivate people to change their behaviour. It would appear that it is only when people feel that they are susceptible to the disease that they will take action to overcome the problem. Furthermore this raised awareness has in turn brought further benefits to the community beyond the initial objectives and it is hoped that this highly beneficial process will continue over time. It is acknowledged, however, that the PAR approach requires intensive planning, involves many parties and various processes.

- The PAR methodology is congruent with the community involvement in health development strategy (CIH).

  It is distinguishable from other forms of research largely by its research and action component that are carried out by the community rather than by external researchers (Smith, 1997). This methodology was selected for the current study primarily because the methodology is committed to solving the problem that it studies, and not just describing the problem. Moreover, the aim of the methodology is also to empower the communities involved in this project to take charge and control over their own health development – which is to prevent dengue.

  The basis of this method is that community involvement, in health projects such as this, is the first step to improving the health conditions in the community through

broad participation built on a variety of activities and involvement by different groups in the community.

CIH has been seen, at least theoretically, to be a fundamental component in increasing health coverage of communities. The World Health Organisation has defined CIH as "a process whereby people, both individually and in groups, exercise their right to play an active and direct role in the development of appropriate health services, in ensuring the conditions for sustained better health, and in supporting the empowerment of communities for health development" (WHO, 1991).

Extensive involvement and participation of communities, not only in supporting and operating health services but also engaging in development activities and programmes for improving their own health, is a fundamental component of the WHO world-wide strategy of Health For All by the year 2000.

The PAR approach used at Kampung Beradek & Semilang has so far been well received by these communities as a means of enabling local people to empower themselves through a process of taking charge of their *own* abilities to acknowledge the problem, investigate the problem and find solutions to the problem.

At the beginning of the project the communities evidently did not feel the need for such a project but within a relatively short period of introducing the PAR programme , the priorities of both communities changed and a far greater level of enthusiasm and participation was observed.

Tangible and non-tangible 'reward' aspects of behavioural change could be observed in the communities as a result of the project.

The '*gotong-royong*' activities appeared to promote a sense of community cohesion, shared directions and objectives. The PAR approach seeks to facilitate empowerment within groups and communities. We believe that the participants' ownership of the programme and autonomy in developing strategies to deal with identified problem areas conveyed that this was taking place.

Eight months after the commencement of the programme, participants continued to comment on the greatly enhanced appearance of the villages; demonstrating a sense of civic pride and a commitment to ensuring that these improvements were maintained.

Connected with these issues, health and well-being were given more emphasis, exemplified by the enthusiasm shown for the Health Authorities plans for the siting of a community health clinic.

The programme had shown that communities can cooperate well with outside agencies as well as within their own community. This new-found ability of strengthened networks empowered the community to advocate on their own behalf with government departments.

The launching day activities represented a high point in the programme and were the focus of almost unprecedented media and public attention for these small, isolated, rural communities. The effects of this focus acted as a powerful message of legitimisation and validation for the kampungs and their impressive efforts and finally, their vital importance to the well-being of the whole.

Focus group discussions have assisted in the process of changing these communities from being passive recipients of disseminated information and action by others, into dynamic initiators of problem-solving strategies.

Based on FGD findings it would seem that both communities have achieved a consciousness that they can be empowered to change their environment and their behaviour for the general health and well-being of all residents. Encouragingly both communities, fired by enthusiasm by the sanitary and aesthetic changes that have taken place, are developing plans of action to maintain momentum in order to prevent a slideback into previous poor conditions.

6.2 Weaknesses

Basic infrastructure needs to be in place before this approach can achieve its full impact on dengue control in the villages.

Problems faced by the communities' internal change agents during their fieldwork are mainly attributed to insufficient resources. There is a need to provide basic infrastructure for the local community such as treated piped water supply and proper waste disposal system by working with other social development agencies. This is to facilitate the gains made by the villagers so that they can maintain and improve on what they have achieved so far. For example, a piped water system will reduce the need for storing water in temporary containers and this in turn will reduce *Aedes* breeding.

The PAR approach is labour-intensive and time intensive.

Adoption of this approach necessitates staff-intensive and time-intensive fieldwork activities. Competing demands to carry out normal routine acitivities for the external change agents as well as for the community's internal change agents means that fieldwork is run on a tight schedule. Because it is time-intensive, prolonged stay of the external change agents with the communities in the villages is unavoidable. Despite the excellent hospitality accorded by the communities, the available infrastructure needed can be less than ideal. From our experience, for example, the meeting place for the community workshops were

found to be uncomfortably hot and could have affected the learning and working environment during those sessions. The external change agents found their accomodation less than comfortable, which could affect their enthusiasm and performance.

This approach also entails some degree of economic loss to the villagers as time is taken away from their usual activities. This will influence the participation of the internal change agents unless we can convince them that the community's long-term gain from the health development project exceeds the immediate economic loss.
Creating a pool of facilitators within the Health Department, as well as in other Departments, who need to use this approach in community mobilisation will ensure there is distribution of work and not burden only the trained few.

- Dynamics in the village power structure also affected the effectiveness of the internal change agents.

  If the majority of the internal change agents consisted of the younger members of the community, the acceptability of the leadership role of the change agents could be more difficult. An initial problem of motivating individuals was commented as having been finally overcome through concerted effort, discussion and persuasion.

- Sustainability of this project is a challenge.

  It was found that the internal change agents needed constant support from the external change agents. This questioned the sustainability of the effected change.

  The results of the follow up entomological survey have called into question the sustainability of this community participation programme.

7. RECOMMENDATIONS

Taking into account the findings from this study and recognising the constraints faced, the resources available presently, and the potential for improvement, the following recommendations have been formulated:

7.1 Qualitative Research Approaches

The PAR approach, the FGD and the appropriate impact assessment methods used in this study can be followed in other public health and social development projects.

This project has shown an alternative means of not only controlling dengue but by extension any health problem which is shaped by human behaviour. In general, qualitative research represents an alternative approach to the more conventionally used quantitative methodology in tackling public health issues in this region. Equally,

moving away from orthodox methods of information dissemination to small communities in the form of leaflets and public talks, may be seen as a bold and innovative step.

7.2 Focus Group Discussion

FGDs have proved to be a useful tool in understanding the nature of the problem from the community's perspective and learning more about the experiences of local people on given topics.

This shared knowledge can only prove to be beneficial in helping to ensure that health goals are mutually agreed upon by the health authorities and local people. Additionally, appropriate strategies are implemented and the expressed needs of the village dwellers are acknowledged and worked with.

7.3 Dissemination

Dissemination of the project to other districts in Sarawak by using the villages as model villages and study trips for villagers from other districts were arranged to learn from the experience of Kampung Semilang and Kampung Beradek.

The project can be disseminated to other areas with a similar background in the country by:

- Utilising the internal change agents to extend the project to other areas.
- Utilising the trainers of the village health promoters as facilitators in the PAR approach.
- Production of training modules and videos on the PAR approach.
- Training of other external change agents such as village health promoters and other health staff.
- Publication of reports.

7.4 Knowledge Level

The knowledge level on dengue must be improved to further increase the participation of the community through:

- Adequate supply of appropriate health materials.
- Further train the internal change agents as knowledge providers for the community.

7.5 Sustainability

The approach could be extended to many other projects and communities in Sarawak as well as other parts of Malaysia with a similar rural background, generating enormously exciting opportunities for health work and other forms of community

development. However, it is too early to be sure that the communities will manage to sustain these beneficial changes.

The sustainability of this community participation programme can be extended by:

- Formulating long term plan of action with the assistance of the local health staff.
- Maintaining a proper resource centre in the village so that the intervention village can be used as a model village for other community participation projects. This will in turn motivate the villagers to maintain and improve their achievements.
- Providing refresher training.
- Expand the role of village health team to include follow-up of this project to maintain interest in this project.

8. CONCLUSION

It remains to be seen whether the PAR approach and FGD can be used on other public health projects with small communities but it would not be unreasonable to say that to date the results of the methodology used in dengue prevention in the Kuching Division, have been encouraging.

The challenge now lies in the sustainability of this project and further evaluation should throw up some insights into the PAR process undertaken to date.

By sharing our experience in doing the study in a rural area, Sarawak hopes to contribute to a comprehensive plan to control dengue through behavioural change in both rural and urban settings.

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PERCEPTION, KNOWLEDGE AND BEHAVIOURAL ASPECTS OF DENGUE CONTROL IN URBAN COMMUNITIES IN KUALA LUMPUR

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1. INTRODUCTION

During 1995, there were widespread epidemics of dengue fever within the Federal Territory, Selangor, and in Johore a high number of cases of dengue fever and dengue haemorrhagic fever (DHF) were recorded (Lam 1996). In the first six months of 1996, statistics from the Ministry of Health showed 4,191 cases with 13 deaths (Dengue Epidemic Review, 1996). In view of the increasing trend over proceeding years, a National Conference on Dengue Control was held in 1996. The purpose of the conference was to deliberate on recent dengue situations and to discuss strategies for more effective control of the problem. Subsequently, several proposals on various aspects of dengue transmission and control, including those, which relate to human ecology and behavioural factors, were submitted for funding. A joint-proposal entitled 'Promoting Behavioural Change in the Control of Dengue and Dengue Haemorrhagic Fever in Malaysia' was prepared by four institutions, namely the Division of Social and Behavioural Research (IMR), the Centre for Drug Research (USM), the Johore Health Department (Johor Bahru) and the Sarawak Health Department (Kuching). The IMR team submitted a proposal entitled 'Community-based Intervention in Dengue Control'. The research received funding from the Ministry of Science, Technology and Environment (MOSTE) under the mechanism of IRPA for three years of its implementation. IMR received RM130,000 (1996), RM70,000 (1997) and RM278,000 (1998).

The team members of IMR comprised the Principal Investigator, a senior researcher and a WHO consultant. Collaborators in the study included a senior entomologist from the Environmental Health Research Centre (IMR), Director of Health Division, City Hall Kuala Lumpur (CHKL) and several health officers of the Division. A statistician and media personnel from Universiti Institut Teknologi MARA (formerly MARA Institute of Technology) were invited to help in sampling and statistical analysis of data as well as to provide advice on media.

1.1 Significance of the Research

The research is significant to the National Control Programme as it contributes to a better understanding of major social, cultural and behavioural factors in relation to the transmission and control of dengue in urban communities. It also contributes to the importance of social science research in disease occurrence and prevention. Most important is the application of research process and findings to other public health research.

2. METHODOLOGY

2.1 Conceptual Framework

Dengue is an arboviral disease that requires the interplay of three main factors, namely, the parasite, vector and the human host. While the disease itself involves mainly biological processes, its spread among population is very much determined by human environmental factors. The rise in dengue fever can be associated with the increase of human activities following social, economic and political changes. Urbanization as a reflection of human progress results in unplanned settlements of population from rural and hinterland areas. The influx of migrants into urban areas and the unparalleled pace of housing development and the basic amenities that go with it give rise to illegal settlements on vacant land. As these are part of urban living environment, they contribute to the creation of suitable *Aedes* breeding areas through improper disposal of domestic garbage and household practices of leaving water uncovered. Thus, these areas are made targets for dengue control activities wherein efforts are directed towards the elimination of breeding areas, destruction of adult mosquitoes, and the promotion of use of personal protective measures.

Control is assumed to be effective if the chain of transmission is broken. Essentially this means that breeding is eliminated through chemical means and that infected adult mosquitoes are killed. In reality, dengue control in urban communities is constrained not only by vector behaviour but also more importantly by human perceptions and activities. Control strategies targeted at breeding sites of vector mosquitoes, are effective if existing sites are eliminated and new ones are not created. This situation calls for individuals and groups in the environment to understand their role in the transmission and control of disease. This may be so if the community is knowledgeable about the parasite-vector-host relationship. However, knowledge per se may not lead to behaviour that prevents transmission of dengue, unless it is related to the people's perception that the disease is regarded as a public health problem.

Through health education the community receives more information on dengue, its treatment and control methods. However, since health education activities are not carried out all the time and are more intensively done during epidemics, communities are not always aware of the problem. Hence, special efforts are needed to stimulate the communities to be more concerned about their health, in particular on dengue infections and to promote communities to practise healthy behaviour.

This is an intervention study which aims at identifying major behavioural factors in relation to the transmission and control of dengue in urban residential areas and at promoting community participation in preventive strategies. In view of this, the research adopted a socio-behavioural approach, which incorporates biomedical, cultural, psychological and environmental aspects of disease control. In the study it is conceptualized that behavioural factors contributing to the occurrence of dengue and its control has to be understood within the context of environmental conditions, activities of health authority in vector control, and social and cultural dimensions such

as the role of the media in health education. It is designed to make the community more responsible for dengue control and to sustain participation in control strategies. An outcome of this is the identification of community resources in mobilizing community efforts towards health promotion.

2.2 Objectives

The specific objectives are:

- To identify the perception and knowledge of respondents with regard to disease causation, seriousness of the disease, and the role of individuals and community in dengue control.
- To formulate behavioural indicators for intervention and evaluative purposes.
- To develop health information materials from the data gathered.
- To assess household and community behaviour in relation to intervention strategies.

2.3 Study and Control Areas

Three residential areas in Kuala Lumpur were chosen on the basis of their socio-demographic characteristics as well as the incidence of dengue in 1994-1996. Selection was done with assistance from the Department of Statistics, Kuala Lumpur. The areas were (i) Taman Tun Dr. Ismail (TTDI) to represent middle-to-upper level income households, (ii) Taman Wangsa Maju to represent a mixed population of lower-to-middle level income group, and (iii) Kampung Abdullah Hukum and neighbouring areas to represent the lower income and socio-economic population. For each study area a control was chosen, Taman Bangsar and close residential areas, Taman Maluri and Kampung Pasir and vicinity, respectively. For each study area, three groups of populations were selected. These are (i) households (ii) secondary and primary schools and (iii) community.

2.4 Data Collection Methods

Prior to actual study, a pretest of the interview schedules was carried out using a general format containing questions on socio-demographic profiles of respondents, perception, knowledge and behaviour relating to dengue, control activities and environment.

For the households, five sets of interview schedules were prepared for all phases of the study. These are (i) General Survey Format (GSF) which contains 34 questions; (ii) Behavioural Indicator Study (BIS) which contains 12 questions; (iii) Intervention Study (IS) which includes two parts: Part I (24 questions) and Part II (16 questions); (iv) Evaluation Phase (EP) which contains 21 questions.

For secondary (SSF) and primary schools (PSF), a perception and knowledge format was formulated. SSF contains 15 questions while PSF contains 11 questions.

A format for collecting information on mosquito species by type of container and locality was designed by the Environmental Health Research Centre, IMR.

For qualitative data, the research used non-participant observations and check-lists to determine natural and man-made water containers and practices relating to disposal of household garbage and environmental maintenance.

2.5 Research Activities

The study was carried out over three years, from June 1996 to May 1999 in several phases during which the following activities were carried out:

Phase 1 (June 1996 – September 1996): General Perception and Knowledge Survey

A general survey on a 10% sample of the population in the study and control areas was undertaken after a pre-test of the study instruments was done. Using a standardized interview format, a total of 3,042 household units were interviewed face-to-face by 16 field assistants under supervision of a senior researcher. The distribution of respondents was as follows:

- Taman Tun Dr. Ismail (n = 547).
- Wangsa Maju (n = 791).
- Kampung Abdullah Hukum (n = 647).
- Taman Bangsar/Lucky Garden (n = 350).
- Taman Maluri (n = 341).
- Kampung Pasir (n = 366).

Following this, a series of focus group discussions (FGD) was held at each study site. Two researchers gathered 6-9 residents representing community leaders, women's groups, adolescents and professionals. Through the FGDs it was possible to gather and assess the community's perceptions, knowledge, and issues relating to dengue transmission and control within each respective community.

Phase II (May 1997 – September 1997)

An intermediate phase was a behavioural study on 20% of the study population (n=1,985). For this purpose, 110 households in TTDI, 156 in Wangsa Maju and 130 in Kampung Abdullah Hukum were selected. The purpose of study was to identify behavioural indicators used by individuals and households for observations and analysis by the researcher. These were grouped into (i) breeding areas of *Aedes,* inside and outside the house (ii) protective measures against mosquito bites; (iv) sources of information on dengue control, and (iv) the agent responsible for control of dengue in the locality.

Phase III, Intervention Study Part 1 (June 1998 – September 1998)

Following the intermediate phase, an intervention phase on 25.5% of the study population was conducted in two parts. Part 1 involved a study of 507 households using format IS Pt. 1 that contained 24 questions. Prior to these household visits, a written request to the house owner for time of visit was placed in their mailbox. Whenever possible, a verbal agreement was obtained from a household member. It was important to get their response, as it would allow researchers to do a general observation of within and outside the house. During visits to the households two sets of dengue information brochures were given to each respondent. Each of these households was to receive an autocidal ovitrap, which is a devise for measuring mosquito specie and density. On the day of visit, a field staff from City Hall Kuala Lumpur (CHKL) placed the ovitrap at a suitable place within or outside the house compound. Monitoring of the ovitraps was also carried out by CHKL. IMR's researchers made observations on household behaviour.

Phase IV, Intervention Study Part 2 (October 1998 – December 1998)

During this phase IS Pt 2 formats (16 questions) were used on households visited during Pt 1 phase. The 507 households were re-visited after a period of four weeks to assess their level of knowledge, perception and behaviour in relation to the information provided in the brochures and the autocidal ovitraps. However, 21 households had to be dropped due to reasons such as the house was under renovation, the owner had gone overseas, or the owner refused to be interviewed.

Phase V (October 1998 – November 1998)

During this phase of the study, three secondary and three primary schools in study areas were chosen for a cross-sectional study on knowledge and perception towards dengue and dengue control. They were Taman Tun Dr. Ismail II Secondary School (n = 149), Wangsa Maju Secondary School (n = 144), and Sri Pantai Secondary School (n = 133). Representing the primary schools were Taman Tun Dr Ismail II Primary School (n = 122), Wangsa Maju Primary School (n = 78), and Bangsar Primary School (n = 161). The SSF and PSF formats were distributed to selected students. Two researchers briefed each group of students prior to setting them to administer the questionnaires themselves. At the end of the time allocated, the researchers collected the questionnaires.

Phase VI (February 1999 – May 1999)

During this phase 50 households from each of the study and control areas were visited for evaluative purpose. Formats containing key perceptional and behavioural aspects in dengue control were used in face-to-face interviews.

Phase VII (May – October 1999)

As a final research activity, each study community was stimulated to organize activities in dengue control. A couple of researchers worked together with the communities' representatives in planning and implementing activities that would involve community members. The first to undertake such an effort was Kampung Abdullah Hukum. The village representatives chose to organize a one-day '*gotong-royong*' with the cooperation of the Health Department, CHKL. Next was Section 5, Wangsa Maju whose residents organized a one-day parent-child family day on dengue awareness. Representatives of TTDI planned a half-day event on dengue control at Tun Dr. Ismail II Secondary School. On each occasion researchers from IMR and USM participated in exhibiting research findings and dialogues on vector control. Handouts were also prepared. CHKL research collaborators participated in providing posters and photographs on mosquito, flies and rat control. Political representatives were invited by each community to deliver a speech and launch the event. Representatives from television stations and local newspapers were present for media coverage of the event.

2.6 Selecting and Training of Field Assistants

For the General Survey 16 undergraduates majoring in Social Science were selected and trained on field surveys and data collection by a senior researcher. They were supervised in the field and when they returned to the office their interview sheets were checked for errors.

For the other parts of the study, graduates were recruited on a contract basis. They were then trained on face-to-face interview methods and fieldwork techniques.

2.7 Design of Dengue Information Brochure

Based on existing health education materials, inputs from media personnel and field observations, an information brochure on dengue was designed by the IMR research team. A three-fold information on dengue and its prevention was pre-tested and finally printed in light and bright colours. The brochure contained messages on laws and fines for breeding of *Aedes*.

It was meant to drive home key points on *Aedes* breeding, human and environmental factors and preventive behaviour. The brochures were printed in four languages, i.e., Bahasa Malaysia, English, Chinese and Tamil. These were used as an intervention tool in the Intervention Phase.

2.8 Constraints

Past control activities in urban communities were much constrained by the apparent indifference of households and business operators towards vector control teams. In the present study, a major factor contributing to people's lack of response to

household interviews is the extent of people's understanding of the purpose of the study and its impact. People fear to allow researchers beyond the iron gate and into the front door of their houses. In Kampung Abdullah Hukum and Kampung Pasir where there are no definite boundaries between houses, the occupants are more willing to respond. This is expected of urban residential areas, which always become targets for door-to-door direct selling activities and surveys for commercial purposes. It was for this reason that special efforts were taken to explain the purpose of the study verbally and with a letter. A note to this effect was also prepared and placed in the mailbox.

Such constraints occurred mostly in Taman Tun Dr. Ismail. Based on researchers' observations it was found that house owners were not at home in the morning while some family members did not want to be interviewed. Maids did not allow researchers to enter the house compounds. In some instances the residents feared the interviewers as they thought they would be compounded if *Aedes* breeding was found in their house compounds. Hence, prior to actual study, efforts were made to inform and request every house owner to fix a time suitable for formal interviews. They were informed the purpose of the study. Except for three households, there was no response at all from the others. This lack of response led to a slow down in Intervention Phase. Some resistance was noted from the TTDI residents, especially during the installation of the autocidal ovitraps. Following a non-response attitude after repeated attempts, the IMR research team resorted to visit the houses directly. To some extent this proved successful.

Researchers faced transportation problems to reach the study areas. Often, research activities were hampered by the unavailability of institutional vehicles. On several occasions, visits to the study areas had to be cancelled due to shortage of vehicles and drivers.

Research activities were affected due to change of research assistants throughout the study period. Since they were temporary staff, there was no guarantee of a long-term service from them. Whenever they found opportunities for more secure jobs they quit. Hence, different researchers had to be engaged for different phases of the project. Added to this was the problem of getting the same respondent for every visit. This constraint could not be overcome, as respondents initially interviewed did not want to commit themselves to repeated visits.

Overall, research activities undertaken by the different research teams faced temporary disruptions, due to the unavailability of funds for about six months at the beginning of each year until clearance for release of the budget was obtained by the Ministry of Science, Technology and Environment.

3. ANALYSIS OF DATA

This section provides the analysis of qualitative data and observations on behaviour of general population and selected groups.

3.1 Perception, Knowledge and Attitude Towards Dengue Control

Perception on Health and Environment

Health is perceived by the general population as top priority in their daily life. On their awareness of the slight presence of mosquitoes, people are slightly worried about mosquitoes as there seem to be few in their vicinity. Drains have been widely cited as mosquito-breeding places. Other sites mentioned include tin cans, flower pots, vases and tyres. People very seldom mentioned roof gutters, septic tanks or water puddles as breeding sources.

From the above, it can be interpreted that people's perception is influenced by the larger drains outside of their house compounds. Clogged or unmaintained drains which cause water to stagnate or flow slowly, is largely seen to be full of mosquito larvae (irrespective of whether they are *Aedes* larvae). Since those drains are outside of individual's home environment, it is the City Council's responsibility to keep them free of blockage. There seemed to be a tendency for people to associate breeding of mosquitoes to 'outside of the house'. This could give them the feeling that their house vicinity is free from water containers that could harbor mosquito larvae. This also reflected their opinion that the health authority has not done enough to upkeep the environment.

Knowledge of Mosquito Vector and Human Susceptibility to Disease

The majority of respondents have knowledge of the role of vector in dengue transmission. They know that mosquitoes have peak biting times, i.e., at dusk and at night. Mosquito abundance is associated with the rainy season. However, they seem to be less knowledgeable on one's susceptibility to dengue infection. This is probably due to their awareness that no one in their family was infected with the disease previously.

Much of the information on dengue is obtained through the television and radio. This is because the Ministry of Health uses both media particularly during dengue epidemics. It is observed that people in TTDI make wider use of printed and electronic media to educate themselves on health issues.

Health-seeking Behaviour

Health-seeking behaviour is linked to respondents' perception of the authority responsible for dengue control. In this context, either the Ministry of Health or the Health Division, CHKL will be alerted in case of a dengue outbreak or an apparent

increase of mosquitoes in the community. Such awareness may also stimulate the people to start looking for breeding source within the house and to get the community to work together to get rid of places for mosquito breeding. From the responses it can be said that the people are of the opinion that dengue control is a joint responsibility of both the health authority and the community.

Effectiveness of Fogging Activity

Generally, fogging is thought to be effective in controlling dengue. Yet, a sizeable proportion of the households do not think so. This suggests that appropriate ways need to be found to improve the effectiveness of control. With more efforts from control teams, residents in middle and upper-level income community of TTDI are willing to allow fogging in their areas.

3.2 Key Behavioural Aspects

Knowledge on Breeding Sites and Agency Responsible for Dengue Control

A second round of interviews with respondents revealed that they have a general knowledge of common places where breeding occurs. As with earlier findings, people's awareness is closely linked to drains as common mosquito-breeding sites. Bottles, bushes, clear stagnant water, cans, drain, drums, tyres, vases, water storage containers, flower pots, and construction sites were specifically mentioned. Construction sites were not mentioned in the general survey. This is important as it reflects that the people's awareness has widened to include the wider environment beyond their house compounds. It can be said that this knowledge is partly attributed to newspaper articles, which highlighted mosquito-breeding in construction sites.

For preventing dengue, the households used insecticides, mosquito coils, electric fans, mosquito nets, repellants and window screens, and also practised closing of doors and windows when mosquitoes are active. On a larger scale, i.e., where the community is involved, fogging by the health authority is thought by TTDI residents to be the appropriate technology, whereas Wangsa Maju and Kampung Abdullah Hukum communities turn to community action or *'gotong-royong'*. To the majority of respondents in TTDI, Wangsa Maju and Kampung Abdullah Hukum, dengue control is the responsibility of individuals and household members.

Most of the respondents think that information about dengue can be best sourced from the television, radio, newspaper/magazines, together with printed health materials. In addition, talks, exhibitions and health campaigns available at health clinics and hospitals can also provide information to all.

The majority of respondents in TTDI (i.e., 59.1%) have received some kind of pamphlets on dengue in the past. In Wangsa Maju, 75.6% said they did not receive any dengue pamphlets. In Kampung Abdullah Hukum, 63.8% said they did not receive any dengue pamphlets in the past. On this basis, it can be stated that

dengue has not reached most households. A better distribution coverage in TTDI can be attributed to the health authority's concern with the high incidence of dengue in the preceding years.

3.3 Key Ideas About Dengue

What is Dengue

Clearly dengue is largely perceived as 'a disease' (24.7%), 'disease from *Aedes*' (28.2%), and 'disease from mosquitoes' (28.2%). A sizable proportion of respondents associate it with 'fatal disease' (16.7%), 'germs that carry dangerous diseases' (2.9%), and 'mosquito bites' (4.1%). The term 'dengue' is sometimes associated with 'fogging activity'. As a disease, dengue is linked to mosquito bites, in particular, *Aedes* sp., connected with this, is the association between mosquito-breeding in stagnant water, a reflection of unclean environment.

Preventive Methods

As 95.1% of respondents believe dengue is avoidable, a most plausible response to the question relating to preventive measures is 'taking steps to avoid mosquito bites' (22.4%), 'getting rid of *Aedes* breeding places' (13.8%), 'preventing *Aedes* breeding sites in residential areas' (13.4%), 'cleaning surrounding areas' (39.3%). A small percentage of respondents thought 'vaccination' (0.4%) as a preventive measure. It is clear from the responses that preventive and control methods refer to some means of biological or chemical control of the vector and personal protection against mosquito bites. Control is partly achieved through human behaviour, i.e., by not creating sites for breeding and by ensuring that one gets medical attention on a regular basis. The assumption here is that while the physical aspects of environment is important; an individual must also be concerned with his/her health status. Hence, the responsibility in controlling dengue lies with the house-owners and the health authority.

Knowledge Level

Based on respondents' level of knowledge on essential points in dengue transmission and control, it was possible to classify their knowledge level. About 6.0% had 'very good knowledge', 34.4% 'good', 38.9% 'moderate', and 16.7% 'so-so' level of knowledge. Education level has positive correlation to knowledge level.

Concern Level

The concern level of respondents corresponded broadly to their knowledge level. Hence, 6.8% has 'very high', 32.7% 'high', 47.7% 'moderate' and 9.1% 'so-so' levels of concern. Concern level seems to be associated with education levels. In TTDI households, which participated in the autocidal ovitraps, study raised their concern over the effectiveness of the devise. They noticed that with the traps in their

compounds there were more mosquitoes than before. They wished that the CHKL would monitor the traps according to schedules.

Observation on Wet and Dry Receptacles

The largest number of receptacles found within house compounds are flowerpots. Of 496 houses visited, 318 or 64.1% were found to have flowerpots. Nineteen or 5.97% of the flowerpots contained water. Other containers were bottles, cans, drums, food containers, hydroponics trays, big leaves, puddles and tyres. From the observations, water receptacles include both man-made and natural ones. In middle-level or upper-level income housing areas, receptacles are generally related to landscaping and hobby activities (e.g., flower pots, big leaves and hydroponics trays). Most house compounds are kept clean as housemaids or housekeepers regularly maintain them. Receptacles from used food and drink containers, tin cans and bottles are mostly found in housing areas without proper domestic waste disposal.

3.4 Students' Perception and Knowledge About Dengue

Knowledge level concerning dengue is high among primary school students. They know that it is a dangerous disease and that it can be fatal. However, it can be treated.

3.5 Evaluation Phase

Knowledge and Concern for Dengue

It is evident that there are no major differences between knowledge possessed by respondents in both the study and control areas. Dengue is understood as a disease caused by mosquitoes of *Aedes* sp. Dengue is a disease mainly characterised by fever or is known haemorrhagic fever which is fatal if not treated. Although some respondents do not know the exact nature of dengue, they knew that it is a kind of disease related to an environment which contained stagnant water.

In accordance with their perception that dengue is transmitted by vector mosquitoes, the majority of respondents feel that people must avoid the *Aedes* mosquito's bites and keep the environment clear of stagnant water.

Their high concern for dengue is supported by their awareness that in recent months they heard of dengue cases in their area and also cases occurring among family members.

Who Should Control Dengue

Since dengue is related to biological, environmental and behavioural factors, most respondents feel that the individual, household and community should take part in efforts to control mosquito breeding within their respective area. These efforts include the cleaning of receptacles containing stagnant water, and using protective methods to avoid mosquito bites. Communities can spread information on dengue

control among residents. On a larger scale, the Health Department of CHKL and Ministry of Health must undertake to clean clogged drains, dry up pools of water, conduct health campaigns where talks and exhibitions are provided. The health authority should undertake fogging when there are cases of dengue in any area.

Importance of Dengue

The majority of respondents (more than 50%) has not heard of any research on dengue. Hence, most feel that dengue campaigns are necessary. Although it is probable that dengue epidemic will occur in the near future, it is important that precautions be taken because every one is susceptible to dengue. People at risk of being infected with dengue are those living in unhealthy environments or in mosquito-infested areas, people with low concern for health, the homeless, elderly, adolescents and children.

Dengue is serious but probably less as compared to other viral infections. To most respondents, Japanese Encephalitis is more serious.

4. ASSESSMENT OF RESEARCH

4.1 Quantitative vs Qualitative Data

Essentially, the research is made up of two parts, (i) quantitative data on individual's personal characteristics and number of breeding sites of vector mosquitoes, (ii) qualitative responses relating to beliefs, perception, knowledge, and behaviour. With regards to the quantitative aspects, it involves a simple gathering of quantifiable variables and description of social, economic and cultural characteristics (e.g., age, education, ethnic, marital status, groups, house ownership, and occupation). With respect to perception about disease, knowledge and understanding of disease transmission, control methods, and attitude towards the research, the data is qualitative in nature. They deal with the individual's state of consciousness over physical existence. They also deal with one's experience and the meaning attached to them. Although the data can be partly quantified, e.g., how many respondents say they 'know' as opposed to those who say 'do not know', without descriptions of the underlying mental view or disposition and emotion, it looses its importance and meaning. For the data to be meaningful, it has to be interpreted from the perspective of society and culture.

4.2 Internal and External Validity

This research was intended to determine households' perception and knowledge, as well as their behaviour relating to dengue and its control. On the assumption that better control of dengue is achieved when people know the disease better, the research process was designed to understand the community and to stimulate it to be more concerned with the issue of dengue control. The identification of perceptual and

behavioural factors was to enable researchers to formulate appropriate messages for dengue information brochures. The use of these brochures as intervention strategy is limited in the sense that its impact on individuals' knowledge level could not be validated, both internally and externally. Referring to Sarvela *et al.* (1993), several factors account for this. First, during the course of research, there were episodes of media highlights and information dissemination by health authorities aimed at promoting better awareness of the community at large. The study communities were no exception. Thus, it is not possible to establish the correlation between knowledge and awareness level and intervention (information brochure). What the research has shown is that people have acquired basic understanding of dengue and its control. As regards their concern level, it could be possible that the research itself had partly influenced their perception and attitude. Second, different respondents took part in different phases of the study. Hence, it was quite natural that different responses were gathered. On this account it cannot be said that the second respondent's knowledge and concern level has been much influenced by the intervention strategy as different subjects were interviewed.

4.3 Behavioural Response to Use of Ovitraps

The results of behavioural response towards use of autocidal ovitraps as a means of measuring mosquito specie and density were available for Taman Tun Dr Ismail only. This is because researchers were present when ovitraps were first placed in respondents' house compounds. In the beginning it was clear that households were keen to have the instruments for the purpose of controlling mosquitoes from their surroundings. They were then informed that the next round of inspection would be done in two weeks. Respondents expressed disappointments when they found the traps overturned or overflowed with rainwater and no inspection was done in the period mentioned. Some poured out the water from the ovitraps when they found them full of larvae. They did this to express concern over the fact that there appeared to be more mosquitoes after the ovitraps were installed than before.

4.4 Community Participation

Ideally, the process of stimulating community participation is done from the beginning of the research. A major obstacle towards this, is the discontinuity of research resulting from change of research assistants throughout the study period. Apart from that, residents of middle-to-higher level income community as represented by TTDI were not acceptable to the idea of having community action in disease control. Community participation, in their view, has to do with *'gotong-royong'*. Community-oriented actions are more appropriate for getting support for fund-raising for some charitable purpose or family day or get-to-know-your community day. As the resident association is represented by well-to-do community members, it usually seeks no special help from outside to organize any community-based activity. Money is no major problem to such communities. What is important is to get every resident's concern and participation in the event organised. Problems such as community's safety get due support, as people are worried about the safety of their life and their

property. On the other hand, a community such as Kampung Abdullah Hukum, which is mostly made up of lower socio-economic status households, is turning to professional assistance to get them funds to run any community actions. However, the actual do-it-together activity, i.e., '*gotong-royong*' is easily done without much stimulation from outside so long as the community believes in its purpose and outcome.

Residents in a housing community comprising middle-to-high level income households have the option of organizing and supporting their own community-based activities. Much emphasis is placed on the activities of children and youths. Working on the partnership activities of kindergarten and parents, the residents of Section 5, Wangsa Maju, organised a family day with the objective of creating awareness about health and dengue. Residents are concerned over the issue of adolescents and youths who spend time loafing and loitering, but are not sure what to do with them. They suggest that the residents' association formulate strategies to get young people interested with useful activities. In the meantime, they believe that change can be stimulated through young children.

5. RESEARCH APPLICATIONS

5.1 Interaction with Community

The research has importance from two major aspects. Firstly, in terms of the research process and outcome and secondly, the findings. With regard to the research process, several points can be learnt. Of major importance are (i) in the planning phase both researchers and community gave obligated time for execution of the research within each study area. In dealing with the generally educated and easily informed community, more time must be allocated to discuss with the community the study objectives and outcome. To achieve this, it is vital that researchers frequently interact with the community. Suitable time must be determined and worked out with residents to get maximum participation from them. In TTDI, residents find the evening hours more suitable and that discussions are better held at a proper place than having them in someone's house. In dealing with traditional societies, researchers must provide adequate discussion on funds and activities involved; (ii) a permanent team of researchers (including research assistants) must carry out the research full time over a given period and funds allocated. During household visits, it was clear that people tried to learn about the research by asking questions and (iii) the study period was spread out over three years during which time follow-up activities were jeopardised due to various reasons.

5.2 Behavioural Interventions vs Other Initiatives

With regard to the findings, it cannot be determined to what extent the research has had an impact on household behaviour in relation to control of *Aedes* breeding. Over the course of the research, efforts taken by the Ministry of Health and the Ministry of

Housing and Local Government to increase public awareness and concern for environmental improvement. Outside the study areas, households and developers were fined for harbouring *Aedes* larvae. These, together with health information through televisions and radios, could have made the people more aware of the problem and thus be stimulated to be responsible for dengue control. Between 1996-1998, there were no major dengue outbreaks in the months of May-July. However, people are occassionally reminded to be on the alert for breeding areas in their house vicinity.

5.3 Appropriate Health Promoting Strategies

Household interviews yield important responses. Respondents in middle and high-income level residential areas are quick to remark that the cause of mosquito breeding is the big drains outside their house compounds. These are frequently found clogged with waste products and unwanted articles and as they are not cleared regularly by the health authorities, water stagnates and thus make breeding conducive. Generally respondents believe that their house compounds are kept free from breeding through household chores. Households in traditional urban communities associate breeding with uncollected rubbish in and people's attitude of not caring for their community. Hence, a change in attitude towards more concern for environmental cleanliness and active participation of community in health campaign activity is expected by such communities. Based on these observations, efforts at promoting community awareness must take cognizance of the social cultural reality operating within a given environmental setting.

6. CONCLUSION AND RECOMMENDATIONS

As dengue transmission is a complex matter, its control necessitates strategies that would contribute to the reduction of the vector species and prevention of the community from the infective bites of mosquitoes. Over the study period, concerns for dengue as a public health issue were affected by government's measures such as the promotion of cleanliness. There were also other major health issues, such as the Coxsackie virus in 1998 and Japanese encephalitis in 1999, that attracted great attention from the public. Variations in responses to knowledge, perception and behaviour reflect differences in social and economic status of community, experience with the disease, and interactions with health personnel, and community's initiatives in health promotion. The study demonstrates that behavioural change requires more than just research activities to promote behavioural change. It requires continued collaborative efforts between health departments, in-depth behavioural research and sustained community participation.

It is hoped that findings of this research be used by the relevant authorities in dealing with dengue control in Kuala Lumpur and other locations. We recommend that (i) vector control programme include on site behavioural research, (ii) health information brochures be reviewed from time to time to reflect changing scenarios, appropriate

messages be formulated, (iii) community provide input whenever dengue control activities are organised, e.g., a dialogue session on TV and (iv) vector control activities suit community's socioeconomic status and environmental setting.

DENGUE CONTROL IN TWO URBAN COMMUNITIES: THE JOHORE EXPERIENCE

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1. INTRODUCTION

1.1 The State of Johore

In Johore, the public health care facilities are well distributed throughout the state. The state has a total of 10 government hospitals. Each of the eight districts has at least one district hospital as well as a network of government clinics. There are also six private hospitals operating in the state.

The two major vector-borne diseases that occur in Johore are dengue and malaria. The morbidity and mortality of dengue cases in the state of Johore for the past 10 years are shown in Table 1.

Table 1: Number of Cases and Incidence Rate of Dengue in Johore 1990 - 1999

Year	Number of Cases	Number of Deaths	Incidence Rate/100,000 People
1990	643	1	39.2
1991	1,222	4	58.2
1992	529	4	34.7
1993	530	4	23.9
1994	525	1	22.9
1995	1,175	3	49.4
1996	1,805	9	73.2
1997	1,793	14	70.7
1998	1,595	24	60.1
1999	957	13	34.7

The incidence rate per 100,000 population for dengue has increased from 14.4/100,000 population in 1988 to 58.2 per 100,000 population in 1991. In 1989, there were 7 deaths related to dengue and in 1995, 3 deaths. Every year, 78-89% of all dengue cases in Johore occurred in urban areas.

1.2. Johor Bahru District

The district has two government hospitals. One of the hospitals, Hospital Sultanah Aminah, is the biggest hospital in the state and is equipped with many state-of-the-art facilities such as MRI. It is also the referral hospital for Johore State. Four out of the six private hospitals are in Johor Bahru District. The district also has a good network

of general practitioner clinics. Every citizen has ready access to any of the health facilities.

The overcrowded Johor Bahru city gives a scenario of a well-developed city. Like other developing cities in Malaysia, it also has its share of squatter population at the fringes of the city. There are also traditional villages in this urban setting.

Dengue in urban Johor Bahru city is becoming a threat to the population at large. The incidence rate per 100,000 people in 1993 was 36.2 with 1 death. By 1995, the incidence rate for dengue increased to 86.8 per 100,000 people with 2 deaths. These increases were mainly due to densely populated areas with rapid development and urbanisation.

2. METHODOLOGY

2.1 Objectives

The objectives of this study are:

- To identify the knowledge and perception of the community with regards to causation, transmission and their role in the prevention of dengue.
- To increase knowledge of the community on dengue transmission and control mainly in source reduction of *Aedes* breeding grounds.
- To set up and train specific groups in a selected community to be responsible for dengue control especially in source reduction.

2.2 Intervention and Control Areas

Four villages located within the City Council of Johor Bahru area were chosen for this study. These four villages are urban villages. They are Majidee Baru, Kampung Hajah Hasnah, Larkin Jaya and Kampung Sri Paya. Majidee Baru and Kampung Hajah Hasnah were chosen as the intervention areas while Larkin Jaya and Kampung Sri Paya were the control areas.

Majidee Baru and Kampung Hajah Hasnah are situated about 10 km from Johor Bahru City while Larkin Jaya and Kampung Paya are situated about 15 km away. These areas are at the fringes of the city of Johor Bahru.

Majidee Baru and Kampung Hajjah Hasnah are well planned urbanised villages with about 1,000 units of houses and an estimated population of 5,000 people each. The major ethnic group in these villages are Malays. The Government built the houses 24 years ago to accommodate the increasing population in Johor Bahru. They were all of the same design initially but now have undergone tremendous changes as the family grew and achieved a higher standard of living. The people are mainly government servants. There are also private sector employees and self-employed workers. The

village has a health clinic with a doctor and also a rural clinic. Primary and secondary government schools as well as religious school with boarding facilities are in the vicinity. Shops and a small market are also available for the population. Basic amenities such as well-developed roads, electricity, water supply and public transportation are also provided.

The two control villages are Larkin Jaya and Kampung Sri Paya. Larkin has 705 houses, which were also built by the Government in the seventies. The bungalow-type houses are build by the state government. The majority of the 3,982 people are Malays who are also government servants in the middle-income group. There are also private sector workers and a small number who are self employed. Basic amenities are available but there is no health clinic to give health services. There are two general practitioners in the area. The villages have no primary or secondary schools but there are four kindergartens. The children go to the nearest schools in the nearby neighbourhood.

Kampung Sri Paya has 310 houses and a population of 1,680. This is an urban squatter settlement and the houses are built in a haphazard arrangement with the basic facilities of water and electricity supply. There are no government schools except for a kindergarten. No health facilities available. Most of the people are self-employed and a small number are government and private sector workers.

2.3 Study Design

The project started in late December 1996. It was divided into 3 components, namely:-

- Pre-intervention studies, namely, on knowledge, attitude and practices (KAP) related to dengue transmission and control of target groups, larval survey and ovitrap setting.
- Intervention (health education).
- Post-intervention studies covering knowledge, attitude and practices (KAP), related to dengue transmission and control, larval survey, ovitrap setting.

2.4 Knowledge, Attitude and Practise (KAP) Survey

The pre-surveys in the intervention and control areas were carried out by contract workers while the post-surveys in both study areas were carried out by two new Public Health Assistants stationed at the State Vector-borne Diseases Control Programme Office.

2.5 Entomology Activities

Larvae Survey and Ovitrap Setting

The entomology team carried out the larval survey. Two Public Health Assistants carried out the ovitrap setting. Both teams carried out the pre- and the post-surveys in the intervention area and the control area. The teams were stationed at the headquarters of the State Office of the Vector-borne Diseases Control Programme.

Aedes Survey

The *Aedes* surveys carried out in the intervention and control areas were to determine the *Aedes* and *Bretaux* Indices. The indoor and outdoor house inspections were carried out. All containers filled with water found were examined for *Aedes* larvae. The container count was carried out during the *Aedes* surveys and the number of the containers examined as well as the containers found positive to *Aedes* breeding was recorded. Any larvae found in the surveys were taken back to the laboratory for identification.

Ovitrap Setting

The ovitraps were placed at an interval of 4-5 days at specific outdoor stations. New ovitraps were placed and the old ones were taken back to the laboratory for egg count and larval identification. Each of the ovitrap was filled with water to cover the paddle and left for 4 days for the eggs to hatch out into larvae. After the 4th day the larvae were counted and identified according to the species. The ovitraps were set continuously from the beginning of the 1997 (for the intervention area) and on the 20th week in 1998 (for the control area). The ovitrap setting exercise was continued until March, 1999.

2.6 The Intervention - Health Education

The staff from Vector Unit, Johor Bahru Health Office, carried out the intervention activities. The activities introduced in the community were mainly the health education components. They were small group discussions, exhibitions in schools and distribution of dengue pamphlets.

The distribution of the pamphlets on the prevention of *Aedes* breeding and its control were done during the larvae survey, the focus-group discussions, the dialogue sessions and the school exhibitions. The exhibitions in the school were mainly on *Aedes* breeding prevention and the destruction of *Aedes* breeding grounds.

Briefing Session

At the commencement of the project, the State Health Vector Officer and other staff of Johor Bahru Health Office gaye a briefing about the project at Kampung Majidee

Baru Community Hall. The briefing was given to 30 villagers who were the community members from the local political group, United Malay National Organisation (UMNO), the religious group, Kumpulan Yassin and other local residents. The purpose of the briefing was to form the Dengue Community Committee.

Small-group Discussions

The District Health Inspector conducted talks and dialogue sessions on dengue to all household members in the intervention area. The Health Inspector and Public Health Assistant also gave talks and dialogue sessions to patients seeking treatment at the rural clinic in Kampung Majidee Baru. This programme was carried out every Monday.

The Senior State Entomologist of Johore conducted the talk on the role of the housewives and their contribution toward dengue prevention. Most of the talks and dialogue sessions were conducted in the evening at Kampung Majidee Baru Community Hall.

Intervention In a Selected School

Two years after the launching of the project, Majidee Baru Secondary School formed an Anti-*Aedes* Committee. The committee was known as Dengue-free School Programme. The committee members are the teachers and the students. The District Health Office provided the exhibition materials and gave technical advice. The Programme's main activities carried out were search and destroy *Aedes* larvae, talks and dialogues on dengue. Other activities were included videos on the experience of students who were infected with dengue fever, search and destroy competition among school uniformed teams, poster drawing competition, '*gotong-royong*,' open day and dengue information dissemination.

3. SAMPLING DESIGN

A random sampling design was used for the study with a sample size of 10% of the population in the intervention and control areas.

There were 279 (pre-intervention) and 222 (post-intervention) respondents interviewed for Majidee Baru. In Larkin Jaya, the control area, the number of respondents interviewed was 553 and 320 for the pre- and the post-surveys respectively. The variations in the total number of respondents interviewed during the pre- and post- intervention surveys were due to high attrition rates.

4. PARAMETERS

The parameters used in this study were

- *Aedes Index* and *Breataux Index;*
- Percentage of houses with containers;
- No. of containers/100 houses; and
- Ovitrap Index.

5. RESULTS

5.1 Socio-demographic Profile

The majority of respondents in both study areas were Malays (Table 2). There were more females interviewed than males in both areas during the pre- and the post-surveys. This was because mostly females were at home during the day when the interviews were conducted. In both intervention and control areas, the majority of the respondents were between the ages of 20 to 49 years. Many respondents from both study areas did not disclose their educational status.

The majority of respondents in the intervention area lived in village type of dwelling. However in the control area most of the residents interviewed during the pre-survey lived in terrace houses (38.7%) in contrast to 96.6% who lived in village houses during the post-survey. The majority of respondents in both intervention and control areas owned their houses.

The household size ranged from 1 to 18 people with the majority of households having 5-10 people. Most of the respondents had a maximum household income of less than RM 1,000 in both the intervention and control areas for both the pre- and post-surveys. It is notable that a sizeable proportion (26.8%) of the respondents in the control area for the pre-survey had income ranging from RM 1,000 – 2,999.

Overall, there are not significant variation in characteristics between respondents interviewed in the pre- and post-surveys from both intervention and control areas. As such, despite the high attrition rate the study respondents covered in both time periods are comparable.

Priority of Basic Needs

Questions regarding five basic needs in one's life were asked. They were health, education, basic facilities, transport and recreation. The respondents were asked to rank their priorities accordingly as: not important, less important, important and very important.

In the intervention area, transportation was placed as top priority by respondents in their list of needs, followed by basic facilities, education, health and recreation. In the post-survey the same order was observed.

In the control area, the first choice in the pre-survey was recreation. The other needs mentioned, were transportation, basic facilities, education and health. In the post-survey, transportation was the most important, followed by recreation, education, health and basic facilities.

Table 2: Demographic Profile

	Intervention Area				Control Area			
	Pre (N=279)	%	Post (N=222)	%	Pre (N=553)	%	Post (N-320)	%
Race								
Malay	278	99.6	221	99.5	544	98.4	318	99.4
Chinese	0	0.0	1	0.5	6	1.1	2	0.6
Indian	1	0.4	0	0.0	1	0.2	0	0.0
Others	0	0.0	0	0.0	2	0.4	0	0.0
Gender								
Male	91	32.6	92	41.4	166	30.0	99	30.9
Female	188	67.4	130	58.6	387	70.0	221	69.1
Age								
<20 years	16	5.7	11	5.0	4	0.7	7	2.2
20-49 years	161	57.7	124	55.9	335	60.6	155	48.4
>50 years	102	36.6	87	39.2	214	38.7	158	49.4
Type of dwelling								
Bungalow	9	3.2	4	1.8	115	20.8	7	2.2
Apartment	0	0.0	1	0.5	2	0.4	1	0.3
Semi-detached	4	1.4	6	2.7	23	4.2	3	0.9
Terrace	1	0.4	5	2.3	214	38.7	0	0.0
Village	265	95.0	206	92.8	199	36.0	309	96.6
Ownership of dwelling								
No response	1	0.4	0	0.0	0	0.0	0	0.0
Rented	55	19.7	38	17.1	75	13.6	34	10.6
Owned	223	79.9	184	82.9	478	86.4	286	89.4
Household income								
No response	65	23.3	80	36.0	86	15.6	55	17.2
<RM1,000	157	56.3	116	52.3	293	53.0	190	59.4
RM1,000 - 2,999	52	18.6	62	27.9	148	26.8	67	20.9
RM3,000 - 4,999	3	1.1	9	4.1	22	4.0	8	2.5
>RM5,000	2	0.7	0	0.0	4	0.7	0	0.0

5.2 Perception, Knowledge and Attitudes Towards Dengue Control

Concern of Mosquitoes

In the intervention area, 55.6% of the respondents in the pre-survey said that they were very worried with the presence of mosquitoes. However, in the post-survey the majority (52.3%) said that they were only slightly worried with the presence of mosquitoes. In the control area, for the pre-survey, 52.8% and 37.4% of the respondents respectively said that they were slightly worried and very worried with the presence of mosquitoes in the environment. In the post-survey, an almost equal percentage of 49.7% and 49.4% of the respondents respectively were slightly worried and very worried with the presence of mosquitoes.

Knowledge About Mosquito Breeding Places

In the intervention area a majority mentioned drains as the major *Aedes* breeding grounds (55.2% and 55.9% pre- and post-surveys respectively). Other breeding sources mentioned in the pre-survey was water storage containers (9.7%) and tin cans (6.5%). After intervention, drains were still mentioned as the major breeding source (55.9%), the percentage of respondents who mentioned water storage containers increased to 28.4% and tin cans increased to 10.8%. About 14% mentioned vases as breeding grounds.

In the control area, 50.1% of the respondents in the pre-survey as compared to 71.9% in the post-survey, mentioned drains as the major source of *Aedes* breeding grounds. Other breeding places mentioned were flowerpots, water storage containers and tin cans.

5.3 Responsibility to Control Mosquitoes

In the intervention area, the pre-survey respondents said that the responsibility to control mosquitoes was by the household and community (80.7%), followed by the local authorities (26.2%) and the Ministry of Health (16.9%). In the post-survey, majority of the respondents felt that control of mosquitoes should be done by the household and community (84.2%), the Ministry of Health (52.7%) and by the local authorities (8.6%). Similar trends were perceived in the control area where 94.0% and 65.0% respectively in the pre- and post-surveys said that the responsibility was with the household and community. Those who mentioned the Ministry of Health as being responsible for controlling mosquitoes increased from 42.0% in the pre-survey to 47.5% in the post-survey.

Action Taken by the Individual and Community

The pre-survey of the intervention area showed that respondents preferred to use insecticides (59.5%), mosquito coils and mats (27.2%) and to clear their own

Note: Total percentages of some variables may exceed 100 percent because of multiple responses to a question.

compounds (17.6%). A similar trend was observed in the control area where 71.4% preferred to use insecticide and 32.9% mosquito coils and mats. While in the post-survey, more people responded on the use of insecticides (72.5%) and mosquito coils (72.1%). In the control area the figures were 73.8% and 74.4% for the use of insecticides and mosquito coils and mats respectively.

It is clearly seen that more people chose insecticide sprays as the first choice while the use of mosquito coils and mats was the second choice in both the intervention and control areas after the intervention. Cleaning of their home environment from mosquito breeding was not a common action taken by them.

On community action to control mosquitoes, the majority mentioned organizing *'gotong-royong'* (10.4%), burning rubbish (0.4%). In the post-intervention survey, 47.8% mentioned burning rubbish as an important community action. In the control area, 42.0% mentioned clearing own compounds followed by *'gotong-royong'* activities (11.6%) as community action. However, in the post-survey 20.9% responded that burning rubbish is a good control measure.

5.4 Mosquitoes and Diseases

Diseases Caused by Mosquitoes

In both the pre- and post-intervention surveys, the majority of respondents knew that mosquitoes is the cause of dengue fever. This knowledge increased during the post-intervention survey to 96.4% as compared to 88.2% in the pre-intervention survey. This is followed by malaria (38.0% and 31.1%) in the pre- and post-intervention surveys respectively.

A similar pattern has been observed in the control area, in the pre-survey 95.1% said that mosquitoes caused dengue, while in the post-survey the percentage was 93.1%. However, the respondents' opinion that mosquitoes could cause malaria fever decreased to 7.8% in the post-survey as compared to 54.6% in the pre-survey.

Diseases that can be Fatal

In the pre- and post-surveys in the intervention area, 87.8% and 95.5% respectively mentioned that dengue could be fatal while 31.2% and 28.8% of the respondents mentioned that malaria could be fatal. In the control area, similar responses were indicated, where the majority of respondents mentioned that dengue could be fatal in the pre- (89.6%) and post-surveys (95.1%) respectively. However, fewer respondents said that malaria could be fatal; 38.9% and 7.8% in the pre- and post-surveys respectively.

Peak Time of Mosquito Bites

In both the intervention and control areas, the respondents had knowledge of peak biting time of *Aedes* mosquitoes that is at dusk; for the intervention area, in the pre-survey 43.0% of respondents mentioned dusk as the peak biting time of mosquitoes; while in the post-survey the percentage rose to 87.8%. There is a similar response in the control area where 65.1% and 95.6% of the respondents knew that dusk was the peak time that *Aedes* mosquitoes bite.

Most of the respondents could not respond to the question on association of mosquitoes with rainy seasons. A small number (17.9% and 18.5% in the pre- and post-surveys) mentioned that the rainy season was a good time for mosquitoes to breed. In the control area, rainy season was mentioned by 15.6% of the respondents in the pre-survey, but this percentage decreased to 6.6% in the post-survey.

How Often a Person Can Get Dengue

In the intervention area, the majority of respondents (41.6%) in the pre-survey and 41.4% in the post- survey mentioned that they could get dengue only once. Around 20.0% in both surveys said that susceptibility to dengue was 2 – 4 times. In the control area, most respondents (68.0%) mentioned 'once' in the pre-survey but this percentage decreased to 8.1% in the post-survey. However, there were more respondents in the post-survey who said that people could get dengue 2 – 4 times in their life (84.1%) as compared to 6.9% in the pre-survey.

5.5 Effectiveness of Fogging Activities

The majority of respondents in the intervention and control areas would allow fogging in their houses. In the intervention area, 92.8% and 91.4% in both surveys respectively would allow fogging in their houses. In both surveys only 5.0% and 7.7% would not allow fogging in their homes. In the control area, 87.3% (pre-survey) and 84.7% (post-survey) would permit fogging in their houses. The number of respondents who would not allow fogging to be carried out in their premises showed an increased slightly, i.e., 10.5% in the pre-survey and 15.3% in the post-survey.

In the pre-intervention survey, 71.0% said that fogging was effective while in the post-intervention survey the figure was 86.9%. The number of respondents mentioning fogging as very effective increase from 2.9% in the pre-survey to 9.9% in the post-survey. In the pre-survey of the control area only 57.1% said fogging was effective whereas 97.5% said so in the post-survey. The number of respondents who mentioned fogging as very effective increased slightly to 1.3% in the post-survey as compared to 0.2% in the pre-survey.

The majority of respondents in both the intervention and control areas mentioned that fogging activities were necessary. The percentage increased from 97.1% to 98.2% in

the pre- and post-surveys respectively. In the control area this was 97.5% and 100.0% in the pre- and post-surveys respectively.

5.6 Suggestions and Course of Action

Personal Protection

In the intervention area, the use of insecticide spray was the choice of the respondents in both pre- (53.0%) and post-intervention surveys (47.6%). The second choice was the use of mosquito coils, (32.5%) and (32.6%) respectively, in the pre- and post-intervention surveys. Similar responses were shown in the control areas, the respondents preferred to use insecticide spray in the pre- (37.1%) and post-surveys (45.5%). The use of mosquito coils was the second choice for the respondents in the pre- (24.3%) and post-surveys (31.3%). Closing the windows before dusk was reported by a sizeable proportion (22.1%) of respondents in the post-survey.

The respondents were then asked where they would use the insecticide. In the intervention areas, the majority of the respondents 47.3% and 51.8% in the pre- and post-surveys mentioned spraying all over the house. Spraying in dark corners was mentioned by 46.0% in the post-survey as compared to 41.6% in the pre-survey. The third popular reply was spraying behind and under the furniture; this was 33.3% in the pre- and 47.3% in the post-surveys respectively. In the control area, 54.6% and 66.9% of the respondents agreed to spray all over the house in the pre- and post-surveys respectively. The respondents spraying behind and under the furniture was 56.2% and 20.0% in the pre- and post-surveys. Spraying insecticide in dark corners was the third choice for the respondents; it was 34.4% in the pre- and 16.3% in the post-surveys respectively.

Course of Action Taken in Case of Outbreak

In case of outbreaks, the majority of respondents in the pre-intervention survey said they would check for mosquito breeding places in the house (66.0%). Calling the authorities to fog their areas was the choice for 15.4% and only 13.3% would check breeding places in the neighbourhood. In the post-intervention survey, there was a change in the respondents' course of action. The majority of 47.3% would check the breeding places in the neighbourhood and call the authorities to fog their areas. About one third each would check for breeding places in the house and arrange for '*gotong-royong*'.

In the control area, the pre-survey respondents would check breeding places in the house (66.9%), followed by checking for breeding places in the neighbourhood (59.5%). About 35.0% each would arrange for '*gotong-royong*' and call the authorities to fog the area. In the post-survey, the first action of the respondents would be to check for breeding places in the house (41.6%), followed by calling the authorities to fog the area (40.3%), checking breeding places in the neighbourhood (24.4%) and lastly to arrange for '*gotong-royong*' (13.1%).

5.7 Perception on Treatment and Health Education

In the intervention area, 99.6% and 100.0% respectively in the pre- and post-surveys would go to hospitals to seek treatment. In the control area 99.3% and 99.4% of the respondents in the pre- and post-surveys would seek treatment in hospitals.

Most of the respondents would seek medical attention for high fever. In the pre- and post-surveys of the intervention area, 64.2% and 42.8% respectively would go to hospitals whenever they had high fever. Similarly in the control area, 34.7% and 39.4% of the respondents in the respective surveys would seek medical treatment for high fever

Means of Health Education

In the intervention area, the two most preferred means of providing dengue information in the pre-intervention survey were through talks (45.2%) and distribution of posters (20.4%). In the post-intervention survey, they preferred health personnel to go on house-to-house visit (47.8%), door-to-door information (41.9%) and health demonstrations (26.1%) and talks (18.9%). In the control area, the respondents preferred house-to-house information in both the pre- and post-surveys, (55.7% and 36.6%) respectively. The second method preferred was door-to-door information, 46.7% and 35.3% in the pre- and post-surveys respectively. In the pre-survey, other popular sources were health demos (33.8%), posters (33.1%) and talks (23.0%). However, in the post-survey, talks in schools (22.8%) was the only other popular source of health education.

Popular methods of obtaining information on dengue in the intervention area during the pre-survey were through radio (73.1%) and newspapers, magazines and books (60.6%). In the post-survey, the percentage increased slightly to 81.5% for radio and 63.1% for newspapers, magazines and books. In the control area, information through radio accounted for 88.2% and 79.1% in the pre- and post-surveys respectively. This was followed by information through newspaper, magazines and books 92.2% and 64.7% respectively in the pre- and post-surveys.

5.8 Entomological Findings

Aedes Survey

There were 1,649 and 920 houses surveyed in the intervention and control areas respectively. There was no breeding found in the *Aedes* surveys. No larvae were found either indoor or outdoor in both the intervention and control areas. The number of containers in the intervention area was 7.6 per 100 houses in the pre- intervention survey and 1.5 per 100 houses in the post-intervention survey. There were 8.0 containers per 100 houses and 2.4 containers per 100 houses in the pre- and post-surveys respectively in the control area.

There were more containers found outdoor for both the intervention and the control areas. Most of the containers were canned food tins and plastic containers. There were also unused household appliances such as kettle and washing machines. Most of the houses did not have fences and small plastic containers were found everywhere especially at Kampung Sri Paya. The drains were clogged with containers and nobody seemed to be bothered about it.

The number of containers indoor was further reduced after the intervention activities were carried out. The same pattern was also observed in the control area.

Ovitrap Setting

In the intervention area, the Ovitrap Index (O.I) was high, 77.5% in the pre-intervention survey; this reduced slightly to 61.8% in the post-intervention survey. In the control area a marked reduction in O.I. was observed from 65.8% in the pre-survey to 35.4% in the post-survey.

6. DISCUSSION

Dengue control in these two urban villages in Johor Bahru using the Community Participation Programme for this project was not so successful due to the fact that the majority of the residents are working in the private sector and on shift duty. This attributed to the difficulty in meeting and gathering of the community for the programme. Furthermore most of the residents felt that it was not appropriate to run the project wholly by themselves. Another reason is that there is no village leader or dedicated influential people in the village to coordinate and liase between the Health Department and the villagers.

There was no community committee formed in the intervention area. The community was supposed to appoint the chairman and committee members by themselves. However this was not carried out. After a lapse of six months and several reminders and efforts taken by the Health Department, there was no response from the community. The team from Health Department then carried out the intervention activities.

Although the community members did not perform as a team they took part individually. By observation, it was found that there was an increase in individual practices in keeping the house and compound clean. It was found out that most houses are keeping their compounds cleaner as compared to before the intervention. However, no real figures to indicate the change could be obtained.

The dissemination of information of the project was not solely aimed at the villagers but also at other institutions such as schools. Majidee Baru Secondary School took the lead to initiate and carry out a dengue-free project. This project is a 'community-based' project whereby all activities were carried out by interested and committed

teachers and students. The District Health Office provided only technical input. The project is still active today.

The method applied in this project was similar to the community-based participation project in Pekan Nanas, Pontian that was launched in 1990. The method was adopted because the investigator had faith that this project would survive as the one in Pekan Nanas does.

Even though the findings from the pre- and post-intervention showed that the household and the community were the ones responsible for the dengue control in their area, they were quite reluctant in participating. Furthermore they still said in the post-survey that the Ministry of Health should be responsible for the control of mosquitoes. This is an attitude problem we are dealing with. At last with the help of the Johor Bahru City council, a resident committee was formed in July 1999 (one month after the completion of the project). Among the functions of the community is to clear the area from *Aedes* breeding grounds. The dissemination of information is through the religious groups, political groups and the newly formed residents' committee.

It was observed that it took a long time to convince and mobilise the people in the intervention area. It appeared that this committee needed more time then the school committee did. (The school committee was formed two years after the launching of the project while the Residents' Committee took two and a half years).

In the urban area it was noticed that

- Health was not given the top priority.
- Adults needed more time to be convinced.
- School children are most receptive.

The intervention and control areas chosen in this study were affected by the dengue outbreaks previously. Many dengue cases were reported from each locality every year for the past five years.

The *Aedes* survey results showed that the people were aware about the disease, the vectors and actions to be taken to destroy Aedes breeding places. Hence no breeding inside the premises was found during the surveys. However, the number of potential breeding grounds was found to be high, 7.6 containers per 100 houses and 8.0 containers per 100 houses for Majidee Baru and Larkin Jaya, respectively. The post-intervention surveys showed a marked decrease in the number of containers found in both localities (1.5 containers per 100 houses for Majidee Baru and 2.4 containers per 100 houses for Larkin Jaya).

The presence of *Aedes* mosquitoes can be determined by using the ovitrap. It seems that the Ovitrap Index (O.I.) is quite high throughout the study period. The Ovitrap Indices for Majidee Baru during the pre- and post-intervention was 77.5% and 61.8% respectively. It showed only a slight reduction as compared to the pre-intervention

data while for Larkin Jaya the marked reduction of the Ovitrap Index from 65.8% to 35.4% was recorded. The marked reduction in Larkin Jaya was observed even though no intervention activities were carried out in this control area. This could be due to many other factors.

The first objective of this study was achieved. The people in the intervention and control areas had a high level of knowledge even before the introduction of the intervention. This could be due to the fact that as outbreak areas before, the health personnel had frequently visited these areas.

The second objective was not fully achieved as planned. A different outcome was achieved. The people in the study area carried out some activities individually but not as a group. This could be due to the problem where in urban areas, people tend to be more individualistic. However after two years, a school in the study area formed its own dengue-free programme committee that is still active till today. The residents' committee was formed one month after the completion of the project.

The third objective was achieved. The level of the people's knowledge, practice and attitude to some extent has increased. More people could identify the right breeding places. Other increases were also seen in the ability to name the dengue vector, awareness of the seriousness of the disease and the methods and means to prevent oneself from being bitten by the mosquitoes.

7. CONSTRAINTS of STUDY

7.1 Activities Carried Out in the Evening

Most of the activities were carried out during the daytime. Certain activities such as the small-group discussions and dialogue sessions were carried out in the evening due to the fact that most of the residents were working during the daytime.

7.2 Temporary Staff

It was a problem hiring temporary staff because of the nature of the work. They were hired for a short period of time with a small pay. These workers preferred to work in the factories due to higher salaries.

7.3 Lack of Cooperation

There was lack of cooperation from the residents even though special efforts were made by the health staff to encourage participation.

7.4 Retirement of Principal Investigator

The principal investigator was transferred on promotion to the State Director's Office in June 1997 and later went on optional retirement in October 1998, thus leaving the project with no capable leadership.

7.5 Distribution of Funds

The distribution of funds by the Institute of Medical Research was only received at the end of the year, thus causing difficulties in the expenditure process.

8. CONCLUSION

In urban settings, the control of dengue is an uphill task as shown in this study. It was found that activities in controlling mosquitoes are still in the hands of the Health personnel even though intensive information of community responsibilities were given during the implementation of intervention activities. The involvement of a well-known and established political person should make some difference. But urban population are always too busy and unless there is a death in the family or they themselves fall ill with the dengue fever they will not be concerned with controlling dengue.

The schools as seen in this study can undertake prevention and control of dengue. The initiative by Majidee Baru Secondary School, is seen as one of the anti-dengue activities in the school and communities. The Ministry of Health has such a programme since 1992 but it was not emphasized by the Health and School Authorities. Reactivating this programme and making it a success will help in controlling dengue outbreaks in urban areas.

PART III

Summary and Recommendations for Dengue Control

IMPLICATIONS OF BEHAVIOURAL RESEARCH FOR DENGUE CONTROL

1. INTRODUCTION

The preceding papers have provided an overview of the dengue fever situation in Malaysia and its control, the role of health education in control programmes, and strategies for promoting behavioural change in dengue prevention and control. In addition to the above areas, the remaining bulk of the papers focused on the research experiences of developing behavioural interventions in four study sites, i.e., households in selected urban and semi-urban communities in Penang, Kuala Lumpur and Johore, rural households in Sarawak and construction sites in Penang. Each of the research papers included a description of research methods used, major findings and specific behavioural interventions implemented in the various study sites.

The following discussion will attempt to draw attention to the major issues associated with the design of behavioural interventions, identify implications for preventive interventions and present recommendations. Particular emphasis is given to strategies that assist in promoting human behaviour change among target populations, enhancing and sustaining community participation in control activities and intersectoral coordination for successful implementation of programmes.

2. HUMAN BEHAVIOUR AND DENGUE CONTROL

Social environment and human behaviour play a crucial role in the transmission and control of dengue fever. Experiences have shown that medical technology alone cannot prevent or control the transmission of the disease if people will not participate or change their risk behaviours.

As indicated in the paper by Satwant Singh and Tham, control of dengue and dengue haemorrhagic fever (DHF) remains a major challenge in this country. Rapid urbanization, population growth, rapid infrastructural development such as opening of highways and poor living conditions in squatter areas have contributed to the significant increase in the incidence of the disease. Current strategies on prevention and control are aimed at vector control (surveillance, source identification, larviciding and fogging), health education, publicity and clean-up campaign and law enforcement. Dengue control in Malaysia has remained predominantly the responsibility of vector control programmes, and measures to reduce the mosquito population and the transmission of dengue are delivered within vertical programmes. It is only lately that the Ministry of Health has given increasing attention to community involvement in dengue control although strategies of this nature are still not well-defined.

3. BEHAVIOURAL INTERVENTION

According to M.L. Wong some reasons why control programmes fail included societal dependency on government to control dengue, health education that stressed on providing information alone, lack of application of behavioural strategies and the implementation of ad hoc activities at the community level without long term sustained involvement.

Wong has clearly identified in her paper, several factors that would contribute to success of control programmes. These include involving the community in planning and implementing of programmes; advocating larval control activities that are relatively easy to perform and that do not require additional expenses of the community as well as designing health education messages that are relevant to specific target populations.

Promoting behaviour change require the identification of risk behaviours associated with proliferation of breeding site, individual and environmental factors influencing risk as well as target groups. It is also necessary to apply theories from sociology, communication, psychology to change behaviour. Wong has suggested using a combination of strategies to motivate, enable and support behaviour change. This could include design of relevant and specific messages for various target groups, involvement of community and experts from different disciplines such as social scientist, health educators, marketing experts, doctors, architects and entomologists. There is also a need to incorporate pressing concerns of the community into intervention. Monitoring and evaluation are recommended as important components of all control programmes.

4. COMMUNITY PARTICIPATION AND HEALTH PROMOTION

The research conducted in the four study sites of Penang, Kuala Lumpur, Johore and Sarawak focused on human behaviour relating to dengue prevention and control. All study sites succeeded in initiating an intervention programme for dengue control, specifically through the control of *Aedes* breeding, with the joint efforts of the community (people), health providers and researchers. For example in Kuala Lumpur, efforts were made to increase the level of community awareness of dengue through health education, together with promoting community participation in dengue control activities such as cleanliness campaign and adoption of the use of an innovative strategy (ovitrap) to control mosquito breeding. A similar approach of involving the community in dengue control was adopted in Johore where residents in two selected semi-urban communities were mobilized to participate in the control of *Aedes* breeding. The project implemented health education activities as well as foster rapport and cooperation between health providers and the communities. The Sarawak team experimented with an interesting and dynamic approach to research and design of an intervention for dengue control through the use of participatory action research (PAR). This indicated the usefulness of PAR as a research as well as operational tool

for mobilizing community input in dengue control activities. The Penang team had worked with the construction sector. The core of the intervention centered on mobilizing and coordinating work with management and construction workers. Targeted health education was designed particularly for foreign workers and technical training for *Aedes* control methods for construction sites were developed and implemented. The project helped to bridge the gap between health providers and managers at construction sites and facilitated them to work in partnership to ensure effective control of *Aedes* breeding. Promoting positive behavior change among foreign workers posed as a challenge given the diverse cultural differences and mindset of these people. They are identified as a unique target group for dengue control.

The above studies highlighted several issues and implications related to the development and implementation of behavioural interventions for dengue control. The major issues include those relating to effective approaches to enhance community participation in selected dengue control measures, such as prevention of *Aedes* breeding; and in initiating and sustaining behavioural change among the various target populations. Whilst targeted health education is important, it proved to be insufficient in motivating behaviour change because of its failure to influence attitudes. Different approaches have to be used such as making the community aware of the linkage between the elimination of stagnant water and dengue-free communities and indirectly the importance of a clean environment. It is necessary to know the people's perception of the importance of health and link this to current control programmes in order to reach out to the community. Health providers have to find the most important entry point (e.g., good sanitation) and take action on it first and then promote dengue control. In summary, health promotion strategies must start with a social diagnosis of the community in order to identify the most important concerns of the community and make the link to health.

As behavioural change involve both individual and environmental factors, interventions can be targetted at the community level to ensure sustainable change. Certain actions are not within individual control so that intervention needs to focus on the community, authority and even policy makers. A common term used by health promoters is the ecological approach where we need to act on the environment (such as provision of piped water supply to eliminate the need to store water). Both social behavioural and environmental approaches are needed.

More efforts need to be taken to motivate people to change through incentives, social support and reinforcement. The law should be used as a last resort. For example, a building contractor should be given incentives to ensure cleanliness of construction sites rather than imposing deterrents in the form of fines and high fees for waste disposal.

Another important aspect of sustainability is to have follow-up action to the programme. For example, Sarawak has successfully implemented many community projects in the past such as BAKAS and Wakil Kesihatan Kampung (WKK) using the

participatory action approach. These projects have been well sustained because of the active involvement of the people in these projects. This approach has been successful because it has constant follow-up activities such as utilizing the village health teams as follow-up agents for intervention programmmes.

The essence of sustained community participation is community ownership of the program. It is important that programmme implementers assist the community to identify their own problems such as control of *Aedes* breeding, identify resources and encouragement to take action on their own so that they can sustain the change. The Sarawak experience of using PAR was thus very appropriate. It points to the potential of using PAR as a tool for further health action at the community level.

More studies are needed to assess appropriate behavioural intervention strategies. Research models are not static and therefore researchers should be able to adapt and be sensitive to the need of each community. Research methodology should ideally include control groups. Time series designs are useful and more rigorous than the pre-post study design. Comparative studies should also aim for factorial designs which can be conducted to evaluate various approaches, i.e., one area using enforcement, another using health education, the third one using both approaches. In real life situations a combination of both designs are needed.

5. RECOMMENDATIONS

To further strengthen implementation of control activities through community participation and positive behavioural changes at the individual and community level, the following recommendations were proposed:

5.1 Behavioural Intervention

- A systematic needs assessment to identify social, cultural and environmental factors influencing behaviour and risk factors for dengue control should precede development of any behavioural intervention.
- There is a need to identify specific behaviour change desired, such as reducing *Aedes* breeding.
- Application of appropriate health promotion frameworks would be useful in designing effective interventions.
- It was recommended that the people's priorities in health be established in order to link them to control efforts.

5.2 Sustainability of Programmes

- The community should be convinced of the short- and long-term benefits of the programme to ensure their participation.
- Efforts need to be made to provide support and reinforcement for the programmes. Health providers can play a crucial role here.
- To provide follow-up action to the established programme.
- Efforts need to be made to support a bottom-up strategy in all phases of the programme, including in its planning, implementation and evaluation. Intersectoral collaboration needs to be strengthened to enhance and sustain community participation in dengue control programmes.
- Roles of both government and community participants need to be clarified to determine programme accountability and to identify possible gaps in activities. Strong links between the government and community are necessary to ensure that appropriate support (technical services and other facilities) are available, and that the programme is sustainable.

5.3 Health Education

- A wider distribution of health education information throughout the public and private sector including residential premises and schools.
- House-to-house visits to stimulate people's awareness by health teams are recommended to complement current activities.
- Multi-pronged health education campaigns such as the use of mass media together with strong collaboration with community action.
- Continous strengthening of health education activities through governmental, voluntary and inter-sectoral cooperation.
- Health information brochures should be constantly reviewed to reflect changing scenarios and appropriate messages formulated.
- Health education should be adapted for specific groups at the construction sites, i.e., construction workers.

5.4 Training

- It is recommended that health staff be used as external change agents to disseminate information and act as facilitators in the implementation of behavioural interventions.

- Training can be conducted for staff with the help of universities and researchers. There should also be a linkage with local unversities as well as getting experts from overseas to help in training programmes.

- Workshop participants recommended that the Ministry of Health through the Institute of Health Promotion draw up a structured training program for health staff in conduct of research in behavioural interventions and how to translate behaviour change into reality.

- To conduct training activities in schools and construction sites targeting specific school staff such as teachers in charge of welfare and health education, and in construction sites, safety engineers/officers and site supervisors.

- Government support for training should be expanded and sustained to ensure the development of technical and managerial competence, and to allow for a natural turnover of key participants.

5.5 Institutional Framework

- To intensify efforts in health promotion, it was proposed that new posts for health inspectors, health trainers and facilitators be created as presently health inspectors are too overworked with enforcement activities and do not have enough time to educate the community.

- It was suggested that enforcement be carried out by the public health assistant and not the health inspectors. As enforcers the effect is different from educator. The function of health personnel should be clarified to avoid performing conflicting roles.

- Aid of NGOs be sought to reach the high risk groups, as these organizations are specialised to do outreach work. We should also involve other organisations such as Department of Ocupational Safety and Health (DOSH) as they have the right to enter the construction sites and they also have the role of educating and training. We should also enlist the help of the Red Crescent to distribute pamphlets; in short we should think of multi-prong strategies.

- There is a need to disseminate information through people who are agents, for example, pest control companies as they have an agenda to promote their chemicals. Use of a multi-modality was recommended.

5.6 Research and Networking

- The network established through this collaborative project reflects a good synergistic effort and it should be sustained and mobilized to continue dengue control activities.

- The existing network should continue to intensify research efforts and to translate research findings into programmes, formulate new policies for dengue control and draw up implementation which are more operational friendly.

- Continual research is vital as communities are dynamic with different target groups and various factors influencing a particular problem situation.

- Researchers thus have to work with programme managers to translate research results into plans of action. Researchers should also look at surveillance indicators, identify problems, collect and monitor the data so as to help program managers to implement the programmes. This effort can be extended beyond dengue problems to other diseases.

- There should be a combined effort and integrated approach involving all change agents to bring about behavioural change (for example, the participatory action research).

- The participants proposed a regional conference to share experiences and sustain the project by focusing on one or two key areas such as develop training packages for schools and construction workers. It was proposed that education and inspection activities be carried out during intensive outbreaks.

PART IV

Appendix

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